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DEPARTMENT OF THE INTERIOR.

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REPORT

OF THE

UNITED STATES GEOLOGICAL SURVEY

OF

THE TERRITORIES.

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F. V. HAYDEN,  
UNITED STATES GEOLOGIST-IN-CHARGE.

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VOLUME XI.

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WASHINGTON:  
GOVERNMENT PRINTING OFFICE,  
1877.





## LETTER TO THE SECRETARY.

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OFFICE OF THE UNITED STATES GEOLOGICAL AND  
GEOGRAPHICAL SURVEY OF THE TERRITORIES,  
*Washington, D. C., May 31, 1877.*

SIR: I have the honor to transmit herewith, for your approval and for publication, the Eleventh Volume of Final Reports of the Survey under my charge.

This Report consists of a series of Monographs of the several North American Families of *Rodentia*, prepared by Dr. Elliott Coues, of the United States Army, now Secretary of the Survey, and Prof. J. A. Allen, of Cambridge, Mass., one of the special collaborators of the Survey—gentlemen whose names guarantee the high scientific character of the work here accomplished.

It has become the settled policy of the Survey to devote a reasonable and proper share of attention to the Zoölogy of the Territories explored, as a subject entirely germane to the main purposes for which the Survey was established, and as one having an important bearing upon the agricultural and other industrial resources of the West. To this end, zoölogists have, from time to time, been attached to the various surveying parties, and have been instructed to avail themselves of every opportunity to acquire information respecting the Fauna of the regions visited, as well as to make collections of specimens illustrating all branches of Zoölogy. The material thus secured has been deposited in the National Museum, where it now remains.

The present series of Monographs is based primarily upon the collections furnished by the Survey; and a glance at the "Lists of specimens examined" which the authors have given in this volume will show the extent of the material thus contributed. Through the liberal policy pursued by the authorities of the National Museum and of the Museum of Comparative Zoölogy of Cambridge, the authors have been enabled to avail themselves also of the

entire collections of Rodents contained in these Museums, amounting in the aggregate to several thousand specimens. No work of the kind hitherto published rests upon such an enormous amount of material, and no naturalists are more competent to elaborate it than the authors of these memoirs have proven themselves to be. Their work, it is believed, will challenge comparison in points of laborious and conscientious research, of accurate and minute detail, and of thoroughly scientific method in study.

The *Rodentia* constitute by far the largest order of Mammals, and one of the most important from an economic as well as scientific standpoint. Though the species are mostly small and apparently insignificant, their relations with man are of much moment. Some of them, like the Beaver, the Muskrat, and others, furnish important articles of commerce; while a large majority of the species directly affect the agricultural interests of the nation. Various species occur in countless multitudes, and constitute one of the most serious obstacles with which the agriculturist has to contend in many parts of the country. It is not easy, therefore, to give undue prominence to a group of Mammals, accurate and full information respecting which is essential to the intelligent direction of measures to stay their ravages. In the present work, the technical history of all the species known to inhabit North America is presented in full, together with their geographical distribution and, in some cases, their habits. The fossil as well as the recent species are considered, and many of the exotic allies, of Mexico and of Central and South America, are also brought under review.

It is now twenty years since the Rodents of North America were revised by Professor Baird, in his "Mammals of North America". This interval almost exactly coincides with the period of the rise and establishment of the theory of evolution, or latest scientific views of the development of species, and their variability under climatic and other conditions of environment. The Rodents of North America have never before been systematically treated from this standpoint, which necessitates a thorough revision of the whole subject. The authors have thus not only been able to avail themselves of a vastly greater amount of material than that at the command of any other investigators, but they have also studiously applied the sounder principles of modern science to the elucidation of the subject. They are well known as leaders among American Mammalogists in this line of research, and their studies have resulted in placing the subject in an entirely new light. It is believed that the publication of this volume will mark an era in the history of Ameri-

can Mammalogy. Being exhaustive of the subject, it necessarily becomes the permanent basis of future work on this group, and remains an enduring witness to the industry, ability, and scientific acquirements of the authors.

A word of explanation of the plan of the work will not be out of place. The Report consists of eleven separate and distinct memoirs, each treating of a single family. The *Muridae*, *Zapodidae*, *Haplodontidae*, *Geomyidae*, and *Sacomysidae* are by Dr. Coues; the *Leporidae*, *Lagomyidae*, *Hystriidae*, *Castoroididae*, *Castoridae*, and *Sciuridae* are by Prof. Allen. The authors, while working together in entire accord, have prepared their respective portions independently of each other, and neither is to be accredited with the work of the other, or to be held responsible therefor. Prof. Allen has alone treated of the fossil species of the order. The general superintendence of the volume during its passage through the press has devolved upon Dr. Coues. The memoirs have been accepted for publication and put to press in the order in which they have been transmitted to this office. Their sequence in the volume, therefore, is not according to the natural classification, which will be found upon a subsequent page.

The Bibliography of North American Mammals (Appendix B), with which the work concludes, has been contributed by Prof. Theodore Gill and Dr. Coues conjointly. Though regarded by the authors as incomplete, it is, nevertheless, by far the most extensive and elaborate exposition of the subject extant.

The thanks of the Survey are due to the Public Printer, the foreman of printing, and the proof-readers and compositors of the Government Printing Office, for the pains they have taken to render the typography of the volume so creditable to all concerned. In this connection, I take pleasure in mentioning particularly Mr. William Young, who may be justly regarded as one of the most accomplished proof-readers of the country, and whose zealous discharge of his duties and long experience in scientific publications have rendered his services invaluable.

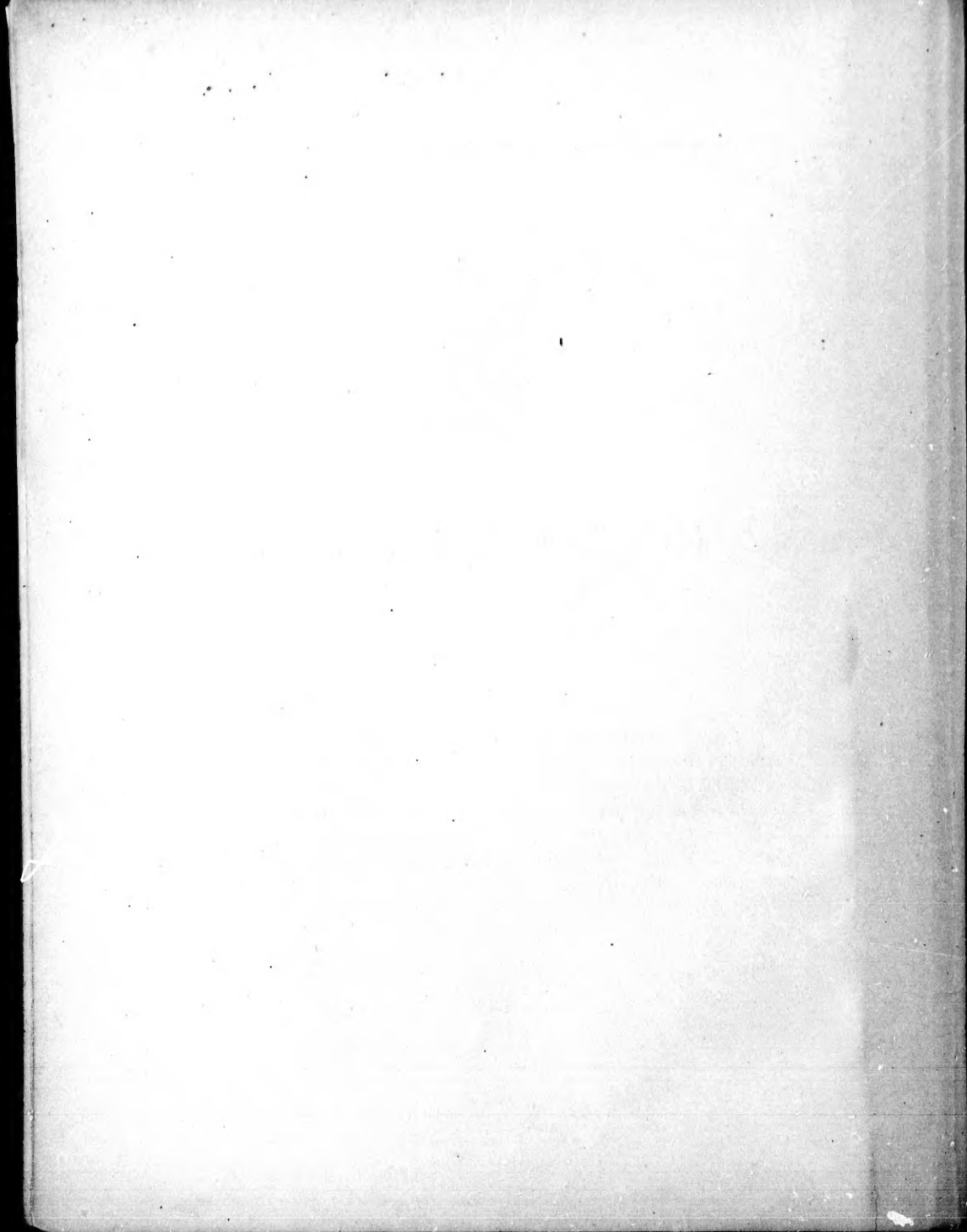
I have the honor to be, very respectfully, your obedient servant,

F. V. HAYDEN,

*United States Geologist.*

Hon. CARL SCHURZ,

*Secretary of the Interior, Washington, D. C.*





UNITED STATES GEOLOGICAL SURVEY OF THE TERRITORIES.

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MONOGRAPHS

OF

NORTH AMERICAN

RODENTIA.

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BY

ELLIOTT COUES,

CAPTAIN AND ASSISTANT SURGEON UNITED STATES ARMY,  
SECRETARY AND NATURALIST OF THE SURVEY;

AND

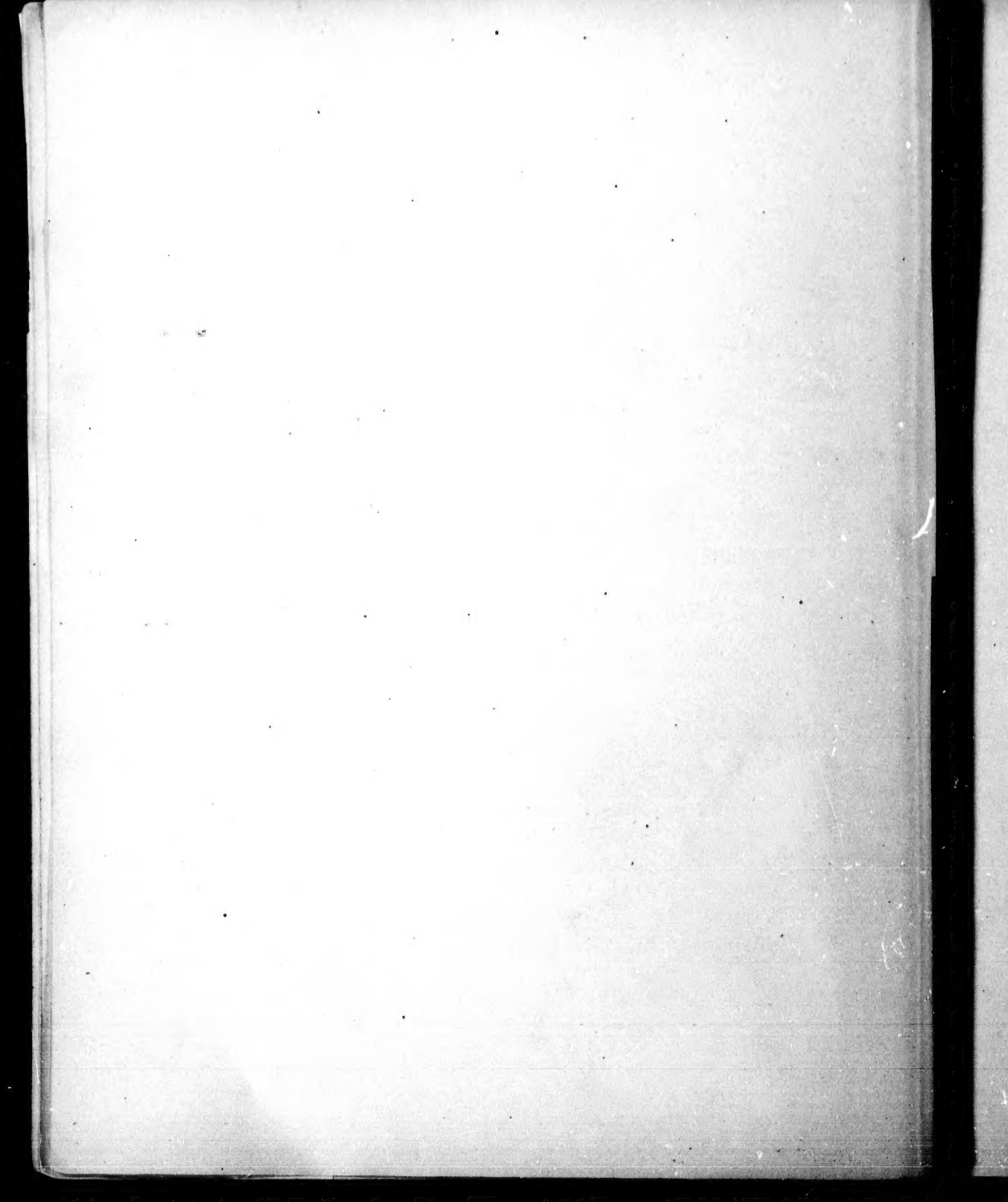
JOEL ASAPH ALLEN,

ASSISTANT IN THE MUSEUM OF COMPARATIVE ZOOLOGY, CAMBRIDGE,  
SPECIAL COLLABORATOR OF THE SURVEY.

---

WASHINGTON:  
GOVERNMENT PRINTING OFFICE.  
1877.

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OR,  
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MONOGRAPHS  
OF  
NORTH AMERICAN RODENTIA.

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NO. I.—MURIDÆ.

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By ELLIOTT COUES.

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## INTRODUCTION.

SMITHSONIAN INSTITUTION,  
Washington, D. C., January 1, 1876.

SIR: A memoir on the *Muridæ* is herewith transmitted as one of the series of "Monographs of North American Rodentia" in course of preparation by Mr. J. A. Allen and myself, for publication by the Survey under your charge.

It is supposed that the series will consist of ten memoirs, each treating of a single family. Those to follow will probably occupy less space than the present one, the *Muridæ* being much the largest family of American Rodents. The successive articles will be entirely independent of each other, and may be issued separately if desired. As the complete series will doubtless make a volume of convenient size, it is suggested that the set of monographs will be available for one of the quarto "Reports" of original investigations, now publishing by the Survey.

Circumstances having been unfavorable to the joint authorship which both Mr. Allen and myself cordially desired, it has been decided to divide the work in another way, each taking up certain families agreed upon. Neither author, therefore, is to be held responsible for the work of the other. Several additional articles are in an advanced state of preparation, and will be presented in the order of their completion, without reference to the natural sequence of the several groups.

The present memoir, prepared in 1872, is based upon the material contained in the National Museum at Washington, the whole of its unparalleled collection of American *Muridæ* having been placed by the Secretary of the Smithsonian Institution in my hands for elaboration. The specimens collected by yourself, or by the Survey under your direction, will be found duly accounted for in the tabular lists. The *suite* consists of several thousand specimens, among them many of the types of American writers, and represents, I have no doubt, much more material than has hitherto been made the basis of any monograph of a single group of mammals

Naturalists commonly complain of dearth of material: I have been embarrassed by the enormous amount I have been obliged to examine in order to faithfully execute my self-imposed task. Every specimen has been made to contribute to the general result. The collection has been catalogued, and labeled according to my views; the duplicates have been made up into about thirty sets for distribution by the Institution. A few of the leading sets are only less complete than the Smithsonian reserve series itself; the value of the others successively decreases with lack of the rarer duplicates.

The results of the investigation being fully—perhaps not without proximity and some repetition—given in the body of the memoir, need not to be here noticed; I only allude to their entirely original character. I wish, however, to have one word upon the method of study I pursued in this case, as determining the shape which the article finally assumed. The paper is presented very nearly as it was originally prepared, my official engagements having prevented any leisurely revision of the manuscript; and it was written in such odd hours as I could find in the midst of active professional duties. I began the investigation with no more knowledge of the subject than any naturalist might have incidentally acquired. I had no "views" to advance, and was entirely free from prejudice. I studied, as I conceive a naturalist should in such cases, with a specimen in one hand and my pen in the other. In taking up the species successively, I never knew, and certainly never cared, what the result would be, being perfectly satisfied to let the specimens tell their own story in their own way. I studied these mice, at intervals, for about a year, and then put my notes together. So the work grew; and if the results be found to square with late progressive views respecting so-called "specific" distinctions, it will be remembered that I am but the mouthpiece of the animals themselves, and claim only the credit of making an accurate report.

On some accounts, I wish that opportunity had offered to revise and condense an article which will doubtless be more respected for the labor it represents and for its possible value as a contribution to knowledge than as a model of literary handiwork. Yet an honest showing of *processes* may have its value, as well as a formal exhibition of results. The knowing how a piece of work is done may be of use in testing its quality.

The illustrations which accompany this paper are from photographs of the objects directly on sensitized wood, by Smillie's process; the engraving was



INTRODUCTION. V

done by Nichols. This method of representing small skulls promised more accuracy than seemed to be attainable, after several trials, by hand-drawing; but the figures should not be relied upon too implicitly.

A short abstract of this paper appeared in the "Proceedings" of the Philadelphia Academy for 1874.

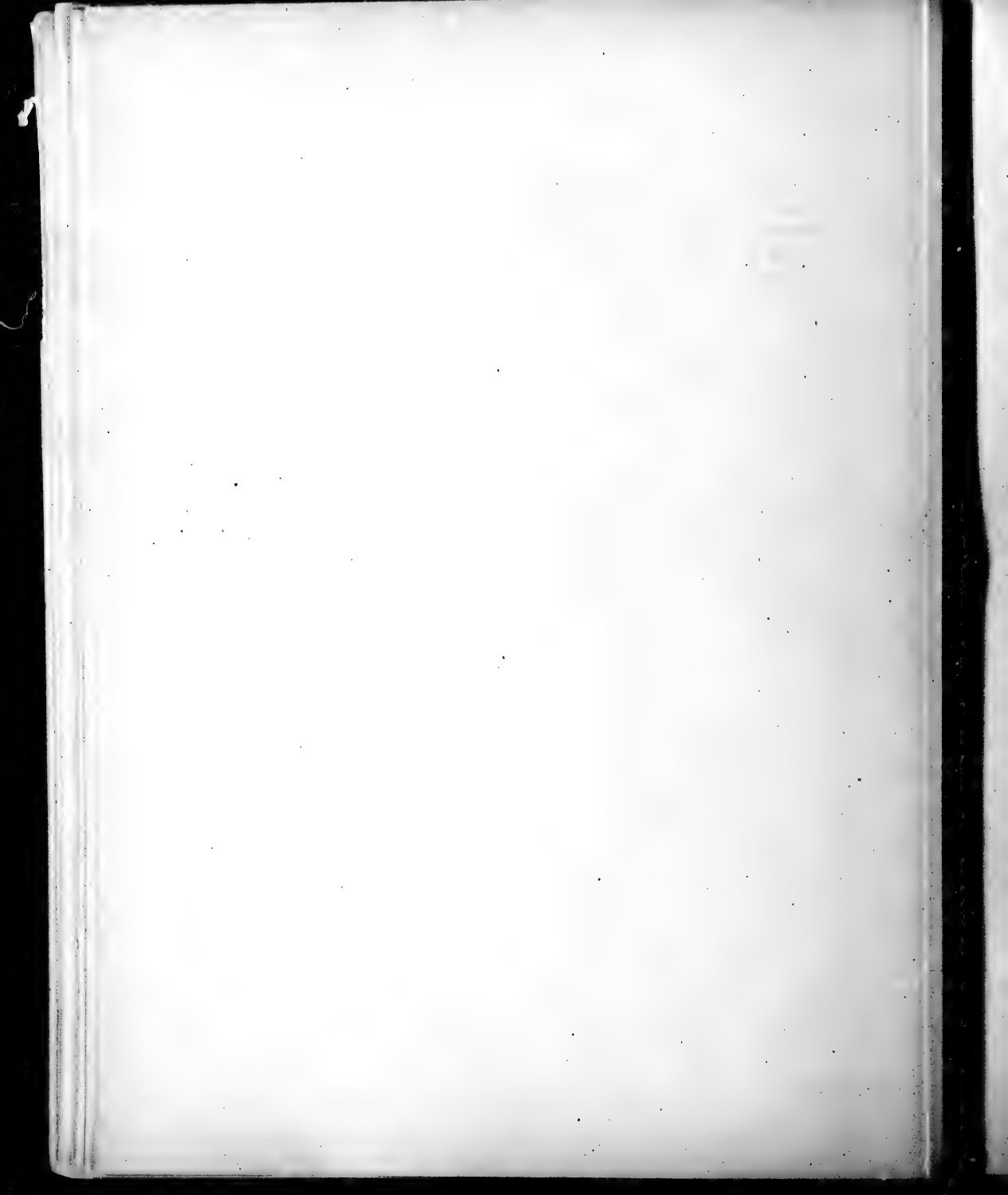
I am, Sir, &c.,

ELLIOTT COUES.

Dr. F. V. HAYDEN,

*U. S. Geologist, &c.,*

*Washington, D. C.*



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## FAMILY MURIDAE.

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The family *Muridae* will be taken in its current acceptation, as far as North American representatives are concerned, but with exclusion of the genus *Zapus*\* (*Meriones* or *Jaculus* of American authors), which, as type of a separate family *Zapodidae*, will be treated in a subsequent memoir of this series. This genus differs sufficiently from any of the *Muridae* in certain cranial and dental characters, proportions of limbs, and other features.

With the exclusion, then, of *Zapus*, the family *Muridae* is represented in North America by only two subfamilies, *Murinae* and *Arvicolinae*, out of the number of groups into which it is usually divided. We are inclined to believe that the same considerations which induce us to eliminate *Zapus* as the type of a distinct family (as has already been done by Gill), would require certain Old World genera, in which the molars are more or less than  $\frac{3}{8}$ , to be likewise separated from *Muridae* proper, which would then be constituted solely by forms in which there are  $\frac{3}{8}$  molars. Such construction of a family *Muridae* would render it rather equivalent to the subfamily *Murinae* of authors. But in our present ignorance of many exotic forms usually brought under *Muridae*, we do not venture upon general considerations touching the definition of the family at large.

As represented in North America, and by the two subfamilies *Murinae* and *Arvicolinae*, the family *Muridae* may be recognized by the following characters:

$$\text{I. } \frac{1-1}{1-1}; \text{ C. } \frac{0-0}{0-0}; \text{ P. } \frac{0-0}{0-0}; \text{ M. } \frac{3-3}{3-3} = \frac{8}{8} = 16 \text{ teeth.}$$

Anteorbital foramen a large pyriform slit, bounded exteriorly by a broad plate of the maxillary. Coronoid, condylar, and descending processes of the mandible well developed and distinct. Tibia and fibula united below.

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\* *Zapus*, n. g., COOPER, Bulletin U. S. Geol. Surv. Terr. 2d ser. No. 5, 1875, p. 253

The character of the anteorbital foramen is peculiar, and probably diagnostic of the group. "This," as Baird has said, "consists of a narrow vertical fissure anterior to the corner of the frontal bone, widening above, and bounded externally by the zygomatic branch of the upper maxillary, which, instead of standing out more or less horizontally, is bent up, so that its anterior edge, at least, is almost in a vertical plane, and parallel with its fellow on the opposite side. In fact, the zygomatic process is divided into three parts: one articulating behind with the malar bone; another completing the enclosure of the foramen just described; and a third articulating with the anteorbital process of the frontal. The inferior narrow part of the anteorbital foramen serves for the passage of the infra-orbital nerve; the wider upper portion, the outlet of which is directed upward, accommodates a portion of the masseter muscle. The suture of the malar bone, with the zygomatic process of the upper maxillary, is distinctly visible; the bone itself does not extend to the frontal bone . . ."

The two subfamilies with which we have to do on the present occasion are well contrasted, at least as far as North American genera are concerned, and may readily be distinguished by the following among other characters which might be enumerated:

**MURINÆ.**—Molars rooted, tubercular, with crenate periphery. Incisors compressed, narrower than deep. Root of under incisor causing a protuberance on outer side of the mandible, at or near notch between condylar and coronoid processes. Descending process of the mandible a broad flattened plate, wholly below the plane of the molars. Anterior root of the zygoma deeply nicked at the anteorbital foramen. Zygoma (usually) dipping down to the level of the palate. Palate nearly plane. Nasals projecting anteriorly.

**ARVICOLINÆ.**—Molars normally rootless (except in *Evotomys*), prismatic, with flat crown and serrate periphery. Incisors often broader than deep. Root of under incisor causing a protuberance, if any, on the inner side of the mandible, at or near notch between condylar and descending process. Descending process of the mandible hamular; the apex of the hook attaining the level of the molars. Anterior root of zygoma not obviously nicked. Zygoma not dipping down to the level of the palate. Palate highly arched. Nasals not produced beyond premaxillaries.

To the foregoing brief diagnostic characters, many points touching the general distinctions in outward appearance, habits, &c., of the groups might

be added. The elaboration of the genera which is to follow renders this, however, in a measure superfluous. We may here only allude, then, to the broad general distinctions—the *Murinae* being animals which include, and, in all their members, recall, the familiar house-rat and house-mouse, of lithe and supple form, quick in movement, having large bright eyes, pointed mobile snout, prominent ears, and lengthened limbs and tail; all of which points are contrasted with the squat and heavy shape, the slower action, very small eyes, blunt snout, inconspicuous ears, and shortened members of the *Arvicolinae*. There is also a striking difference in the *ensemble* of the dentition of the two groups—the compressed and comparatively small incisors of *Murinae* as against the large broad fore teeth of the *Arvicolinae*—the small, tubercular, and rooted molars of the former, in contrast with the great, flat-topped, prismatic, and continually-growing grinders of the latter, in which it would seem that the perfection of rodent dentition is attained.

In their geographical distribution in America, moreover, the two groups, though associated to some extent, differ decidedly. The *Arvicolinae* occupy the northern half of the hemisphere; they are not known to occur farther south than Mexico; they are most numerous represented by individuals in high latitudes, while some of them are among the most arctic of mammals. The northern limit of the *Murinae* is, perhaps, not exactly known; but they do not reach the arctic seas, while they are most abundant in temperate and warm climates, and spread over Central and South as well as most parts of North America.

In the following table, prepared with much care, the cranial and dental characters of *Murida*, as represented in North America, are exhibited. The points brought out, it will be observed, are of varying grade, from those that run through both subfamilies down to those that particularize the subgenera, and serve to indicate the several degrees of relationship which subsist between the respective groups.

[illegible]





Diagnostic table of some cranial and dental characters of North American MURIDÆ—Continued.

	MURIDÆ.												
	MURINÆ.						ARVICOLINÆ.						
	Mures.			Sigmodontes.									
	Mia.	Neotoma.	Sigmodon.	Ochetodon.	Vesperimys.	Oryzomys.	Hesperomys.	Arvicola.					
								Myonomys.	Chilotas.	Pedomys.	Pitymys.	Eveomys.	Synaptomys.
Molar crowns:													
Tuberculate, crenate-edged:													
Tubercles triseriatim .....	+	..	..	..	..	..	..	..	..	..	..	..	..
Tubercles biseriatiim .....	..	+	+	+	+	+	..	..	..	..	..	..	..
Prismatic:													
Sharply angular, both sides .....	..	..	..	..	..	..	+	+	+	+	+	+	+
Sharp one side, obtuse the other .....	..	..	..	..	..	..	..	..	..	..	..	..	..
When fully worn, consisting essentially of one dentine area, within an enamel wall, which, however deeply plicate, does not fuse from opposite sides .....	+	+	+	+	+	+	..	..	..	..	..	..	..
Even after wear still consisting of several dentine islands, owing to fusion of the enamel walls from opposite sides .....	..	..	..	..	..	..	+	+	+	+	+	+	+
Molar series:													
Strongly convergent anteriorly .....	..	..	..	..	..	..	..	..	..	..	..	..	..
Little, if any, convergent anteriorly .....	..	..	..	..	..	..	+	+	+	+	+	+	+
Rather divergent anteriorly .....	+	+	+	+	+	+	..	..	..	..	..	..	..
Upper molars:													
Of approximately equal size throughout .....	..	..	..	..	..	..	..	+	+	+	+	+	+
Decreasing in size from before backward .....	+	+	+	+	+	+	..	..	..	..	..	..	..

### SUBFAMILY MURINÆ.

The characters of this subfamily having already been given in sufficient detail for present purposes, we may at once proceed to consider its subdivision into the two tribes or series of genera; namely, *Mures* and *Sigmodontes*. This separation of the Old World (*Mures*) and New World (*Sigmodontes*) representatives of the subfamily seems to us warranted, and not alone upon geographical grounds; for a decided difference in dentition is found, serving for their immediate identification.

**MURES.**—Molars of upper jaw, with the tubercles in three series. Palate extending back of the molars. (Palæogæan.)

**SIGMODONTES.**—Molars of upper jaw, with the tubercles in two series. Palate ending opposite last molars. (Neogæan.)

The *Mures* which occur in North America,—namely, four species

of the typical genus *Mus*,—not being indigenous to this country, and being, moreover, among the best-known of mammals, will not be treated in the present paper.

#### Tribe SIGMODONTES.

Under this head come all the *Murinae* indigenous to America. Those of the northern division of the hemisphere may be grouped under four genera,—*Neotoma*, *Sigmodon*, *Ochetodon*, and *Hesperomys*; the latter with three subgenera. Full descriptions of these and of their respective species follow.

#### GENUS NEOTOMA, Say & Ord.

*Mus*, sp., SAY & ORD, 1818-23.—DESMAREST, 1822.

*Arvicola*, sp., HARLAN, 1825.

*Lemmus*, sp., FISCHER, 1829.

*Neotoma*, SAY & ORD, Journ. Acad. Nat. Sci. Phila. iv, pt. ii, 1825, 346 (type, *N. floridana*).—AUD. & BACH., Quad. N. A. i, 1849, 31.—BAIRD, M. N. A. 1857, 486.—COUES, Proc. Acad. Nat. Sci. Phila. 1875, 174.

*Myoxus*, sp., RICHARDSON, Zool. Journ. iii, 1828, 517 (*N. cinerea*).

*Neotoma*, J. E. GRAY, Proc. Zool. Soc. Lond. 18—, p. — (*N. cinerea*).

**CHARS.**—Embracing sigmodont rats of the largest size; highly murine in general aspect; peculiar to North and Middle America. Snout pointed, mobile; whiskers very long (the longest ones reaching to or beyond the shoulders); eyes large and full (as in *Dipodomys*); ears very large, orbicular, nearly naked. Tail long, nearly equaling the body with or without the head, either scant-haired (nearly as naked and scaly as in *Mus*) or bushy (much as in *Myoxus*). Feet small, but broad for their length, with short toes; the fore with four perfect clawed digits, which in length run 3d, 4th, 2d, 5th; and a rudimentary thumb bearing an abortive nail; the hind with five perfect clawed digits, the middle three of which are subequal and longest; the 5th is not much shorter, its claw reaching about to the base of the 4th claw, while the 1st reaches about to the median node of the 2d. Palms naked, 5-tuberculate; one tubercle postero-external, another postero-internal near base of pollex; two at bases of 2d and 5th digits, respectively, and one at base of 3d and 4th digits together. Soles naked at least for their anterior two-thirds—the posterior third hairy in northern species, mostly naked in tropical forms; furnished with seven tubercles, thus: one near postero-external angle of foot, only evident in naked-soled species;\* a larger one a little farther in advance on internal border; another (smaller) in advance of this externally; three

\* Hardly a true tubercle, however; being merely caused by protuberance of the subjacent bone, over which the skin is not particularly thickened.

large ones at bases of 1st, 2d, and 5th toes, respectively; and one at conjoined bases of 3d and 4th toes; those at the bases of all the digits, except the hallux, being more or less confluent.\* Pelage soft, lustrous, white below.

To the foregoing characters, rather descriptive than simply definitive, and indicating little else than an overgrown *Hesperomys*, we may add the following more diagnostic features, derived from the skull and teeth:

Skull elongate, twice (at least) as long as wide, in spite of the divergent zygomata; these do not sink to the level of the palate, and turn toward the squamosal almost at an angle (*cf. Hesperomys*). Maxillary boundary of ante-orbital foramen developing no pointed process (*cf. Sigmodon*). Palate ending as a simple emarginate or concave shelf, opposite the interspace between last and penultimate molars; the palato-maxillary suture opposite the interspace between first and middle molars (*cf. any other sigmodont genus*). Incisive foramina very short. Foramen magnum broader than high. Auditory bullæ rather small; their axes very oblique to the axis of the skull. Nasal bones not reaching as far back as nasal branches of intermaxillaries, which gain the interorbital region. No definite bead on upper margin of orbits. Interparietal bone subquadrate, but with a large, well-defined spur on each side. Posterior aspect of skull truncate; *i. e.*, the occipital plane is about perpendicular, meeting the flattened superior surface of the skull nearly at right angles (in all other genera, the coronal rounds more or less gently into the occipital surface). Under jaw with long, acute, coronoid process, overtopping condyle; root of the under incisor causing a moderate protuberance on the outside of the jaw, rather at the root of the condyle itself than at the notch between condyle and coronoid. Teeth of the ordinary sigmodont pattern; nearest to *Hesperomys* proper, and, as in that genus, decreasing regularly in size from first to last—in the upper jaw at any rate; in the lower, the last tooth conspicuously smaller than either of the other two. All the upper teeth with usually two external and one internal reëntrant loops of enamel (but the first often with a supplementary internal loop, and the last often with only one external loop). First and second under molars each with two internal and two external reëntrant loops; last under molar with one of each. In unworn teeth, all the reëntrances open, the saliciencies correspondingly sharp and divaricating, thus simulating the prismatic structure of *Arvicoline*; in old teeth, however, these

\* The tubercles at bases of all the exterior fingers and toes show a tendency to develop little accessory tubercles upon their outer faces.

appearances are obscure or lost. Upper molars mostly 3-rooted; under with only two roots apiece.

In amplification of the characters of this genus, we continue:

*Neotoma* shows us the largest murine skull of North America, and many strong generic characters. The zygomatic width is relatively greater than in other forms, amounting to half the length of the skull, mainly in consequence of the outward obliquity of the zygomata, which diverge from each other as they pass backward, instead of lying nearly parallel. The same length of skull, with parallel zygomata, would much exceed twice the zygomatic width. They also do not dip so low down as in most other genera, not descending to the level of the palate; and the union of the jugals with the squamosal spurs is abrupt, almost angular. In general contour, there is an observable difference in the two sections of the genus—that with scant-haired tail and the bushy-tailed species; the latter having the rostral portion of the skull more lengthened and the interorbital constriction greater. In *N. floridana* the interorbital width is about one-seventh of the total length, and rather exceeds the rostral diameter, though this is swollen. The nasals are much widened anteriorly, where they end with crescentic outline; behind, they stop opposite the anterior roots of the zygomata, and always (we believe) in advance of the nasal branches of the intermaxillaries, which reach into the interorbital constriction. In most other genera, there is no special difference between the length of the nasals and the intermaxillary behind, or else the difference is fluctuating. At the extreme antero-superior corner of the orbit, the maxillary, just where it unites with the frontal, throws up a tubercle for muscular attachment stronger than we have noticed in other genera. The thin plate of the superior maxillary that forms the outer wall of the anteorbital foramen has a gently-rounded anterior border, with its convexity looking forward, instead of running into a sharp point as in *Sigmodon*, where the same edge is deeply concave by reason of this pointed process; and likewise, when looked down upon from above, the foramen appears as merely an emargination instead of a nearly-closed oval. The edge of the orbit is sharp above, but not beaded. The interparietal is moderate and subquadrate, with a spur; the paroccipital processes are strong; the tympanic bullæ medium; the pterygoids large, hamulate, and fenestrate. The foramen magnum is remarkable for its depressed elliptical shape, being usually much wider than high; the condyles are far apart at the ends of the major axis. The palate ends behind as a simple shelf with concave border opposite the last molars

or space between these and the penultimate pair. The incisive foramina are of nearly usual size and shape; they do not quite reach to the molars. The under jaw is noticeable for the great size of the coronoid process, which overtops the condyle. The descending process is large, subquadrate, and flatfish, with the under edge thickened and curled inward.

With a general resemblance to that of *Sigmodon*, the molar dentition of *Neotoma* exhibits a mentionable tendency to recede from the ordinary sigmodont style, and approach the arvicoline, in the somewhat prismatic nature of the extra-alveolar part of the teeth. The teeth, however, are firmly rooted, and the arvicoline bent is after all little more than a superficial resemblance. The upper teeth are 3-rooted, as usual in the tribe, each with two exterior and one interior fang; but the anterior two of these are often or usually (except in the first tooth) more or less fused together. The under ones have only two prongs, *seriatim*. The tuberculation of the molar crowns is an open question: we have never seen any teeth not worn flat, and cannot, therefore, speak of the character of the tubercles, if such exist after the teeth are extruded from the gums; and, at any rate, this fact indicates a tooth that grows much more rapidly than in *Mus*, *Hesperomys*, or *Ochetodon*. It is much the same with *Sigmodon* as with *Neotoma*. The teeth, as in *Hesperomys*, &c., decrease in size from first to last, in both jaws, though in this case there is less difference; for the posterior upper one is at least two-thirds as large as the anterior one, and is but little less plicated. In the upper series, the decrease is regular from first to last; in the lower, the middle tooth is as large as the front one, but the back one suddenly diminishes in size nearly one-half.

Average adult examples show a state of the teeth as follows: All the upper ones are trilobate externally, bilobate internally; that is to say, there are, upon the outer side, two deep, open indentations, where the enamel-sheet loops into the tooth, and, consequently, three rounded saliciencies or lobes, as just mentioned; while on the inside there is one such indentation, or loop, opposite the middle of the tooth, producing two such rounded saliciencies. On the front upper molar, however, the antero-interior lobe is slightly indented, making three lobes in all, as on the outside. The interior reëntrant loops of enamel are wide open and shallow, not reaching half-way across the face of the tooth; the exterior loops, on the contrary, are very deep, reaching nearly or quite across the tooth. At the outset, these exterior loops are wide open, like the interior ones; but they soon shut, the two folds of enamel being mutually

appressed, and thus, as one double enamel fold, they penetrate the tooth. The apex of the antero-exterior loop in each upper tooth abuts against the apex of the single interior loop; the apex of the other exterior loop abuts against the surrounding wall of enamel of the opposite side; and thus the crown is divided into three distinct dentine islands. But, in other cases, these reëntrant promontories of enamel do not reach either the internal loop or the inner wall; then we have a straggling dentine area on the face of the tooth partially cut up into three. The faces of the crowns differ in sculpture to a considerable degree with age, as in other genera; but, owing to the more prismatic form of the teeth, this variability is not so great as in *Hesperomys* or *Mus*, and the pattern above described will be found essentially preserved in most cases, except in the extremes of youth and old age. In very worn teeth the reëntrant folds are all ground out, leaving a single irregular dentine area surrounded by a crenulate enamel wall, as in *Sigmodon*, &c.; at one period, there are enamel islands left in this area. The back molars wear down from the condition above described to a simple figure-of-8, or hour-glass shape. The under molars differ from the upper in being more complicated, but also vary among themselves to a greater degree still. In the upper, moreover, the lateral protuberances are essentially alternate (there being two outside and only one inside); while in the lower, there being the same number of indentations on both sides, these are opposite. The front and middle lower molars are extremely similar to each other, both having two reëntrant loops and three rounded saliencies (all mutually opposite), so that their crowns make a figure-of-8, with an extra loop. The chief difference between them is that the anterior lobe of the front one is enlarged a little, and shows a shallow indentation. The apices of the lateral reëntrant loops abut each against its fellow, by which means the crown is divided into three dentine spaces, one behind the other; often, however, the ends of the loops do not touch, so that passage-way is left from one dentine space into the others. The hinder tooth may be best described as a two-thirds of either of the others: i. e., it is a figure-of-8 *without* the extra loop above mentioned; it has one reëntrant fold of enamel on each side, opposite the middle. These folds may meet or not in the center of the tooth; and, in very old teeth, the grinding-away of the folds leaves simply a somewhat irregular subcircular crown.

One specimen shows an instructive condition of this last under molar. The exterior reëntrant loop is becoming detached from the side-wall of enamel,

and about to appear as an island of enamel in the dentine area. This is exactly what occurs in *Hesperomys*, &c.

Upon attentive consideration of the subject, we conclude that there is really no *essential* difference in the molar structure of our several genera; that *Neotoma* and *Sigmodon* merely wear off their teeth faster than *Hesperomys* does; that the pattern just described for *Neotoma* is indicative of early maturity; that with age the reëntrant folds of enamel are ground off from their connection with the general enveloping sheet, and appear as islands of enamel in the general dentine area; and that, finally, these islands are rubbed out, when we have, as a condition of senility, a continuous, depressed dentine surface bounded by a raised, indented wall of enamel.

We tabulate together a part of our skulls of the several species, both real and nominal. The difference in the length of muzzle of the bushy-tailed species is evident from the figures.

TABLE I.—Measurements of eighteen skulls of various species of *NEOTOMA*

No.*	Locality.	Total length.	Height†	Zygomatic width.	Inter-orbital width.	Length of nasal bones.	Length of lower jaw.‡	Remarks.
3442	South Atlantic States....	2.10	0.72	1.08	0.27	0.77	1.40	<i>floridana</i> ; perfectly adult.
3443	.....do.....	2.05	0.70	1.05	0.25	0.77	.....	.....do.
2050	Saint Simon's, Ga.....	2.00	0.68	1.02	0.25	0.75	1.30	<i>floridana</i> ; mature.
2201	.....do.....	1.90	0.65	.....	0.25	0.70	1.25	.....do.
1642	Southern States.....	1.80	.....	.....	0.22	0.68	1.20	<i>floridana</i> ; youngish.
2460	Georgia.....	1.98	0.61	0.98	0.24	0.76	1.25	<i>floridana</i> ; nearly adult.
2465	.....do.....	1.68	0.62	0.84	0.21	0.61	1.10	<i>floridana</i> ; quite young.
2160	Sonora.....	1.80	0.62	0.97	0.22	0.65	1.22	" <i>mexicana</i> "; mature.
3507	Fort Tejon, Cal.....	1.95	0.68	1.02	0.23	0.76	1.23	.....do.
3508	.....do.....	1.87	0.65	0.94	0.23	0.72	1.18	.....do.
3509	.....do.....	1.84	0.62	0.95	0.26	0.71	1.22	.....do.
3600	.....do.....	.....	.....	0.92	0.22	0.70	1.12	.....do.
3601	.....do.....	1.92	0.65	0.95	0.25	0.75	1.20	.....do.
3602	.....do.....	1.90	0.68	0.95	0.21	0.70	1.20	.....do.
2040	Santa Clara, Cal.....	2.10	.....	1.12	0.25	0.77	1.40	<i>fusciipes</i> ; adult.
1676	Charco Escudido, Mex.....	.....	.....	.....	.....	1.20	.....	" <i>micropus</i> "; adult.
6883	Washington Territory....	2.10	.....	1.07	0.20	0.86	1.43	" <i>occidentalis</i> "; adult.
4202	Deer Creek, "Neb".....	2.05	.....	1.05	0.25	0.82	1.45	<i>cinerea</i> ; adult.

\* Of the specimen, in the register of the National Museum, Smithsonian Institution, and on its label. The same with regard to the numbers in the first column of each table throughout the present monograph.

† Taken by laying the skull on a flat surface, and measuring perpendicularly from the surface to the highest point of the parietals. The same mode of measurement in subsequent tables.

‡ From the tip of the incisors to the back of the condyle. The same, in following tables.

N. B.—Measurements, throughout this article, are in decimals of the English inch.

We tabulate none of the very young skulls before us, as these would vitiate the results, especially as regards the lengthened muzzle of the bushy-tailed species; the young of that animal not having the snout noticeably different from that of the rest. The difference in length of snout between *cinerea* and *floridana* does not seem to be much from the figures; but a tenth of an inch on the end of a rat's nose is something; and, viewing the naked skulls, the rostral part in *cinerea* is seen to be slenderer, as well as longer, than it is in *floridana*; the interorbital space is more constricted and more deeply indented. Aside from this, the skulls show nothing diagnostic among the several real or supposed species. Adult ones average about two inches long (1.84 to 2.10) by an inch broad (0.84 to 1.12) across the zygomata, and barely over two-thirds of an inch in height (taken as described—see under Tab. 1, p. 12). The extreme length of the under jaw is about an inch and a fourth on an average, but runs from 1.10 to 1.45; a part of this difference being due to the fluctuating length of the under incisor. This generally protrudes one-half of an inch, or a little more; the upper incisors protrude about one-third of an inch. The molar series is from three- to nearly four-tenths of an inch long; there is nothing diagnostic in its length.

In connection with the rostral elongation of the skull of *N. cinerea*, we should note another slight peculiarity—not, however, diagnostic of species, much less of sections of the genus. In all the western skulls examined, including even those of *N. floridana*, there is a tendency to a narrowing of the conduit of the posterior nares by more or less filling in of bone from the alveolar border. Thus, in ordinary South Atlantic *floridana*, the whole palate is deficient behind the point indicated in the generic diagnosis—nothing bounds the space on either side but the alveolus itself. In the other extreme, there is quite a little shelf on either hand, noticeably narrowing the aperture. But the feature is extremely variable, and cannot be relied upon for even specific diagnosis.

We know three good North American species of this genus: first, there is the ordinary *N. floridana*, really inhabiting most of the United States, except New England, though decidedly southerly, and ranging thence into Mexico; secondly, the *N. fuscipes*, which appears to be perfectly distinct, and is a highly interesting animal, opening the way, through several of its features, into the tropical aspect of the genus, such as is exhibited by the *N. ferruginea* of Tomes, from Guatemala, and furnishing an analogy to the



long black-tailed, partly dusky-footed, style of *Hesperomys* witnessed in such a species as *Nyctemys sumichrasti*; thirdly, the still more peculiar *N. cinerea* of British America and various western Territories—an animal that, although a true *Neotoma*, shows us the densely hairy, almost bushy tail of *Myoxus*—a condition, in fact, that would almost equal a squirrel's, were the tail perfectly distichous instead of rather terete. It has, indeed, been made the type of a different genus, *Tronoma*, but this, like many of Dr. J. E. Gray's genera, need not be adopted. We tabulate the three species, together with the Guatemalan one.

*Analysis of species of NEOTOMA.*

1. TAIL SCANT-HAIRED (nearly as in *Mus*), *bicolor*, grayish and whitish, in length at most *barely equaling the body without the head. Feet entirely white.* Adults with the general body-colors of the Norway rat, but more fulvous on the sides; white below; young, gray or slate. Upward of 9 inches long; tail upward of 6; hind foot upward of 1.50. Skull averaging 2 inches ..... FLORIDANA.
2. TAIL SCANT-HAIRED, as before, *unicolor, blackish, nearly as long as head and body* (up to  $8\frac{1}{2}$  inches). *Feet partly dusky.* General body-colors as before, if anything darker. Averaging larger than the last? ..... FUSCIPES.
3. TAIL SCANT-HAIRED, as before, *unicolor, blackish, nearly as long as head and body. Feet partly dusky.* General body-colors of adults *rich warm rusty-red*, hardly darker on the back; *under parts snowy*, with distinct line of demarkation. *Small*; upward of 7 inches; tail nearly as much; hind foot under 1.50; skull about 1.75 ..... FERRUGINEA.
4. TAIL DENSELY HAIRY (as in *Myoxus*), *bicolor, brown or gray, and white.* Size of *floridana*, or even larger; body-colors of *floridana*, but varying between dark plumbeous and pale luteous ..... CINEREA.

NEOTOMA FLORIDANA, Say & Ord.

Wood Rat.

*Mus floridanus*, ORD, Bull. Soc. Philom. Phila. 1818, 181.—DESMAREST, Mamm. ii, 1822, 307.—SAY, Long's Exped. R. Mts. i, 1823, 54.  
*Arvicola floridanus*, HALLAN, Fn. Amer. 1825, 141; Med. and Phys. Res. 1835, 53, pl. x, f. 1, 2, 3, 4.

- Neotoma floridana*, SAY & ORD, Journ. Acad. Nat. Sci. Phila. iv, 1825, 352, pl. x, f. 1, 2, 3, 4; Zööl. Journ. ii, 1825, 294, pl. x, f. 1, 2, 3, 4; Isis, 1827, xx, 1035.—GRIFFITH, Anim. Kingd. iii, 1827, 160, pl. —AUD. & BACH., Q. N. A. i, 1849, 32, pl. iv.—GEOFFROY, Zööl. Voy. Venus, 1856, 154, pl. xiii.—KENNICOTT, Agric. Rep. U. S. Patent Office for 1856 (1857), (no text), pl. xiv.—BAIRD, M. N. A. 1857, 487.—MAXIMILIAN, Arch. Naturg. xviii, 1862, p. —; Vers. N.-Am. Säug. 1863, 165.—ALLEN, Bull. Mus. Comp. Zööl. ii, 1871, 189.—COUES, Proc. Acad. Nat. Sci. Phila. 1874, 175.
- Lemmus floridanus*, FISCHER, Synopsis, 1899, 990.
- Neotoma mexicana*, BAIRD, Proc. Acad. Nat. Sci. Phila. 1855, vii, 333; M. N. A. 1857, 490; U. S. & Mex. Bound. Surv. ii, pt. ii, 1859, Mamm. p. 44, pl. 94, f. 1, a to g (skull).—COUES, Am. Nat. i, 1867, 399.
- Neotoma micropus*, BAIRD, Proc. Acad. Nat. Sci. Phila. vii, 1855, 333; M. N. A. 1857, 492; U. S. & Mex. Bound. Surv. ii, pt. ii, 1859, Mamm. p. 44.

**HABITAT.**—Southern United States and Northern Mexico. North, sometimes, to Maryland (*Audubon*), New York (*Beil*), and Massachusetts (*Gibbs*). Dakota. Illinois. Kansas. Arkansas. Very abundant in the South Atlantic and Gulf States, New Mexico, Arizona, and parts of California.

**DIAGNOSIS.**—*N. (adultus) luteo-brunnea, dorso obscuriore, lateribus fulvescentibus, infrà alba, pedibus niveis, caudâ bicolore; (juv.) supra schistaceo-grisea, infrà candida. Long. tot. 6-9-poll., caudæ 4-6-poll., cranii bipoll., pedis sesquipoll.*

The adult animal is colored above very nearly like the Norway rat, but is brighter, and still more so on the sides. The difference is parallel with that between *Ochetodon humilis* and *Mus musculus*. Thus, *Ochetodon* is precisely the color of a house-mouse, except that the sides have a fulvous or pale dull pinkish-brown wash; and in this *Neotoma*, while the back is finely lined with brownish-gray and blackish, as in the *Mus decumanus*, the sides are quite tawny or fawn-color, especially near the line of demarcation between this color and the white of the under parts. The color of the upper parts runs down on the legs, but stops abruptly at the wrists and ankles, leaving the back of the hands and feet snowy white; this is invariable in all the specimens examined. The under parts are white; on the throat, breast, and lowest belly, this color is pure, the fur being white to the very roots; but across the middle belly, and on the insides of the limbs, and along the sides of the body generally, the appearance is only whitish, because the ashy bases of the hairs show through. On the head, the color of the upper part is rather darker or grayer than elsewhere, and the extreme snout is of this shade; but the whole upper lip is broadly white, like the under. The whiskers, which reach to or beyond the shoulders, are part black, part white. The ears, which are dusky in the dried state, perhaps showing somewhat of flesh-color in life, are nearly naked on both sides, and especially inside; but close inspection shows

n scanty pilosity, especially outside; they are very large and nearly orbicular, with moderate antitragus. On the tail, the long body-hairs run out a little ways beyond what seems to be its true root, and occasion some discrepancy of measurement with different persons. This member is rarely, if ever, quite so decidedly naked and scaly-annular as in *Mus*, though often closely approaching this condition. The most naked and scaly and least bicolor tails are generally shown by the original *floridana* from the South Atlantic States; while western specimens, even those from deserts, as the Camp Grant ones below tabulated, have more hairy tails, and the hairiness reaches a maximum in some Kansas examples. Here, not far from the habitat of the bushy-tailed species, we find tails, of which the hairs are a fourth or even a third of an inch long, completely concealing the annuli, forming a slight terminal pencil, and, in fact, not distinguishable at first glance from some of the scantiest-haired (early-spring) specimens of *cinerea*. In these examples of *floridana*, the tail is sharply and perfectly bicolor—slaty-gray above, pure white below; and, in general, the upper surface of the tail tends to a gray, darker than the back. The soles are closely pilous as far as the posterior tubercle, and a slight fringe continues all along their sides. The disposition of the tubercles has already been given; in this species, the posterior one, that shows in naked-beeled species like *ferruginea*, is not apparent. These tubercles, and generally most of the sole, are blackish; the toes, and the whole palms, flesh-colored.

The changes of pelage, with age, are precisely as in *Hesperomys leucopus*, and most other species of that genus. The young animal is slaty-gray above and slaty-white below, almost black along the middle of the back, a little more brownish on the sides. This color insensibly gives way to the normal hues of the adults; there are no definite intermediate stages. In the very youngest animals, the hands and feet are snowy-white, as on the old; a fact particularly to be noted in connection with the study of *N. fuscipes*.

In specimens from the same locality, there is not very much individual variation in color, it would seem, aside from the conditions of immaturity. As a rule, the southern-coast specimens are the darkest and most rat-colored, with most indistinctly bicolor tails, lacking the brighter fulvous hue that marks those from the dryer regions of Kansas and Arkansas. As noted elsewhere, all the prairie Murines and Arvicolines, if not, indeed, all the prairie mammals, show the same thing. The pallor reaches its maximum in the specimens from

the deserts of Arizona and New Mexico. Here the characters tally precisely with those of *Hesperomys* "sonoriensis" or "gambeli"; indeed, they only fall short of the extreme seen in *Hesperomys* var. *eremicus*. The general hue, instead of a rat-brown mixed with blackish, is a dull pinkish fulvous or fawn, especially on the sides, intermixed on the back with a few black hairs. The heels are somewhat less hairy, and the ears a trifle larger, more "foliaceous" and nude. At the same time, curiously enough, the tail, instead of being extremely naked, as was to have been anticipated, is even hairier than in Georgia examples, and approaches the Kansas maximum in this respect. The young animals from the same region are paler gray than usual, corresponding to some samples of *Sigmodon* "berlandieri"; and some show a slight silvery margin of the ears, as usual in desert *Hesperomys* "sonoriensis". It is hardly necessary to add that this extreme, witnessed only in animals from the Colorado and Gila deserts, is mixed and obscured in every degree in the animals living in neighboring wooded and watered regions, and is directly connected with the Georgian extreme by Texan, Coloradan, Arkansan, and Kansan examples.

The supposed *Neotoma* "mexicana" rests upon these points of coloration; for, as we learn from the table given below, nothing in the way of measurements ascribed to it is distinctive. The species was originally based upon a few specimens, all in very poor condition, some of them indicating the extreme stage above described. Had Professor Baird possessed at that time the intermediate series we now command, it is doubtful whether he would have differed from Geoffroy as to their specific identity with *floridana*; a matter of which, in our mind, there is no question.

The case of *Neotoma* "micropus" presents some difficulty, owing to lack of material; we have nothing additional to Professor Baird's two\* types. One of these, No. 561, is so young, that the molars are not cut at all! the skull measuring only 1.08, or about *half* the normal adult average. We will, therefore, confine our attention to the other specimen, No. 554. This has the appearance of being mature, or nearly so, except that it is, as stated, in a grayish-slate state of pelage. In the first place, we may dismiss the impression that would be gained from the name "micropus"; the feet being exactly as long as in samples of ordinary *floridana* or "mexicana", and quite as large. Of the many cranial characters adduced, we fail, with the skull in our hands,

\* Nos. 554, 561, published in M. N. A.—Besides these, we find in alcohol, from Santa Rosalia (Conch), two others, Nos. 9699, 2700, labeled "micropus". They are, however, mere sucklings (about three inches long), and afford no characters at all.



TABLE II.—Measurements of sixty specimens of NEOTOMA FLORIDANA—Continued.

Number.	Locality.	Collector.	Nose to—				Tail.	Hind foot.	Ear.	Remarks.
			Eye.	Ear.	Occiput.	Tail.				
8868	Arizona.....	E. Palmer.....	1.00	1.60	1.90	7.35	4.75	1.25	0.90	Dry.
8869	do.....	do.....				6.35	4.75	1.25	0.90	Dry.
8870	do.....	do.....	1.00	1.80		7.50	5.50	1.35	0.85	Dry.
8871	do.....	do.....	0.95	1.70	1.85	7.00	4.75	1.15	0.95	Dry.
8866	do.....	do.....				7.50	5.75	1.30	1.00	Dry.
8863	do.....	do.....				6.75	5.00	1.20	0.95	Dry.
8865	do.....	do.....				7.25	4.90	1.20	0.90	Dry.
8867	do.....	do.....				7.40	5.00	1.20	0.95	Dry.
8864	do.....	do.....				8.00	5.75	1.30	1.00	Dry.
8860	do.....	do.....				6.25	4.60	1.25	0.95	Dry.
8870	do.....	do.....								Dry; young.
8871	do.....	do.....								Dry; young.
8905	do.....	do.....	1.05		2.00	7.50	6.00	1.25	1.10	Alcoholic.
8906	do.....	do.....				5.00	3.75	1.15		Alcoholic; not grown.
9089	Colorado River, Ariz. to 1330 to 1343	W. H. Emory.....								No. 9089-94 are alcoholic; very young.
9090										No. 9095-6 are alcoholic; embryos.
1330										Alcoholic; very young.
1343										
1338	do.....	do.....				10.50	6.75	1.33	1.00	Dry.
1339	do.....	do.....				9.00	6.00	1.30	0.95	Dry.
1033	Sonora.....	do.....								Mounted.
565	do.....	T. H. Webb.....				6.00		1.17		Dry.
389	Chihuahua.....	J. Potts.....				7.50		1.18	0.84	Dry.
554	Mexico.....	D. N. Conch.....				9.00	4.25	1.40	0.90	Dry; Types of "montanus", Bb.
561	do.....	do.....				6.50		1.40	1.70	Dry; Types of "montanus", Bb.
9090	do.....	do.....								Alcoholic; very young.
9700	do.....	do.....								Alcoholic; very young.

## NEOTOMA FUSCIPES Cooper

## Dusky-footed Wood Rat.

*Neotoma fuscipes*, COOPER, MSS.—BAYARD, M. N. A. 1857, 495.—COOPER, Proc. Acad. Nat. Sci. Phila. 1874, 176.

DIAGNOSIS.—*N. caudæ unicolore, nigricante, elongatæ, truncum sine capite æquante sive excedente, pedibus suprâ partim fuscis, auriculis plantisque ferè nudis; nigro-badia, infra albida. Long. tot. 9.50 poll., caudæ 8.50, pedis 1.60.*

HABITAT.—California.

This remarkable rat is much unlike any other of the genus we know of. With a general agreement in form with other species of the scanty-haired tailed group, there are striking differences, the first of which that we shall

notice is the length of tail. In *N. floridana*, the tail only exceptionally equals the trunk without the head; in *N. fuscipes*, the tail is only exceptionally so short as this, ranging usually from a little more than length of the trunk to the full length of the trunk and head together. Besides its length, the tail in the dried specimens shows the peculiarity remarked by Professor Baird, being compressed for its terminal third, somewhat as in the muskrat. At first, we thought this was a taxidermal or other accident, but all the specimens show the same thing; so that, whether or not the tail be compressed in life, it, at any rate, dries in that shape. Nothing of the sort occurs in *N. floridana*. The pilosity of the tail is about the same in the two species. The ears of *fuscipes* are larger than those of *floridana*, although the general size of the two animals is nearly the same. The soles of *fuscipes* are nearly naked throughout, but not perfectly so; a scant hairiness occupying the posterior third of the sole, which is densely furry in *floridana*. The general pelage of *fuscipes* is coarser and harsher than it is in *floridana*, although the difference is not very noticeable; not more so than that between prairie and forest examples of *N. cinerea*. In other respects, of size, form, and pelage, we note no essential characters.

In color, however, there are likewise marked features, the most prominent of which is the nearly uniform blackishness of the tail, and the next most so is the duskiness of the hind feet. This peculiarity is uniform and very conspicuous in all the specimens examined. The surface of the metatarsus is dark-brown, like the outside of the leg; the toes being abruptly white. This coloration and that of the tail are especially interesting in the geographical connection mentioned below. In general color, the animal is of a darker and warmer shade than ordinary *floridana*, and many times deeper than the pale desert-breed of the latter from neighboring regions. The main color is a strong reddish-brown, overpowered with blackish on the back, but very bright on the sides. The under parts are white, as usual; the hairs on the middle line white to the very roots, but those along the sides of the belly ashy at root. On the fore leg, the dark color runs to the wrist and then stops abruptly; on the hind, as stated, it reaches the roots of the toes.

We have not specimens enough to show the full range of variation in size and proportions; but these, no doubt, are perfectly parallel with those of *floridana*; and, similarly, we cannot give the entire variation in color. We should judge, from the restricted area that this species occupies, that its colors

would only vary as much as, say, those of South Atlantic coast *floridana* do. We have no very young animals before us; but Nos. 1159 and 1182 show much the same signs of juvenility that the same ages of *floridana* do. The gray, however, is not so slaty; being more lined with yellowish-brown, resulting in a color almost identical with that of *Mus decumanus*. The feet are dusky, quite as in the adult.

We should very much like to see specimens of this species from other localities, especially a little to the southward, where the physical influences that give the peculiar *facies* to Mexican *Muridæ* could be observed at play. As De Saussure has remarked (*l. c.*), there is a tendency to extension of the color of the back down the legs and on to the feet in the Mexican forms of *Hesperomys*; thus, in *H. aztecus*, the basal third of the metatarsus is sharply dusky, while, in *H. (Nyctemys) sumichrasti*, the whole metatarsus to the toes is dusky. These two species also finely illustrate two other parallel tendencies: these are, to the change of the ochrey or yellowish-browns of northern species into a rich rusty red, with lengthening and blackening of the tail. *Neotoma ferruginea* of Guatemala and Southern Mexico shows likewise all three of these features. *Neotoma fuscipes*, with closest relationships, if any, to Mexican forms, shows us the beginning of changes that appear to culminate in *N. ferruginea*; but we have no links to excite suspicion that it is not perfectly distinct from the last named, as it certainly is from any other United States species.

Mr. Samuel's Petaluma examples are strictly identical with Cooper's types.

• The Fort Tejon example is interesting, and merits special mention. By referring to our table of *N. floridana*, it will be seen that we record three specimens of that species from this locality; these are pure *floridana*, absolutely identical with South Atlantic styles; they do not even approach in color the paler "mexicana" of the neighboring desert regions. But No. 3655 is equally pure *fuscipes*; the dusky occupies the posterior two-thirds of the metatarsus, and the tail, which is only an inch shorter than the head and body, is of a nearly uniform blackish color all around. This occurrence, at Fort Tejon, of the two species of *Neotoma*, each preserving its own characteristics, confirms the specific distinctness of *fuscipes*, and is an interesting parallel with the case of the *Hesperomys* of the same region; for it will be seen further on, that while the ordinary mouse of Fort Tejon is the "gambeli" strain of *leu-*



*copus*, yet the singularly different *H. californicus* (*parasiticus* of Cooper) also occurs there; and that some of the samples of "gambeli" seem to tend a little toward *californicus*. Here appears to be the gateway, both in *Hesperomys* and in *Neotoma*, that leads out from an ordinary type into a localized differentiation. We must confess that we suspect that certain intermediate *Neotoma* and *Hesperomys* will yet be found in this region to show us the steps of departure from *N. floridanus* into *fuscipes* and from *H. leucopus* into *californicus*.

The skull of *N. fuscipes* shows nothing diagnostic; a slight narrowness of the post-palatal notch being shared by the other western and Mexican forms. One example, No. 2040, measures 2.15 in length by 1.15 across the zygomata.

TABLE III.—Measurements of six specimens of *NEOTOMA FUSCIPES*.

Number.	Locality.	Collector.	Nose to—				Tail.	Fore foot.	Hind foot.	Ear.	Remarks.
			Eye.	Ear.	Occiput.	Tail.					
1158	Santa Clara, Cal .....	J. G. Cooper .....	.....	.....	2.95	0.00	8.50	0.75	1.55	1.10	Dry; adult; type.
1159	.....do .....	.....do .....	.....	.....	.....	.....	6.50	0.80	1.60	1.00	Dry; young.
1183	.....do .....	.....do .....	.....	.....	.....	9.50	7.10	.....	1.02	1.05	Dry; young.
2679	Petaluma, Cal .....	E. Samuels .....	1.07	2.00	2.40	8.30	7.90	0.85	1.58	1.20	Alcohol; adult.
2680	.....do .....	.....do .....	0.66	1.56	1.95	6.35	6.35	0.76	1.22	1.00	Alcohol; young.
3635	Fort Tejon, Cal .....	J. Xantus .....	.....	.....	.....	7.50	6.50	0.70	1.35	1.00	

### NEOTOMA FERRUGINEA, Tomes.

*Neotoma ferruginea*, TOMES, Proc. Zool. Soc. 1861, 251. (From Guatemala. Described as bright rufous, mixed with black hairs on the back, below pure white, the line of demarcation distinct. Length 6" 6", head 1" 9", fore foot 8", hind foot 1" 2", tail 6".)—COUES, Proc. Acad. Nat. Sci. Phila. 1874, 175.

DIAGNOSIS.—(No. 9507, Mus. Smiths., ex Tehuantepec.)—*N. aureo-ferruginea*, dorso obscuriore, infra nivea, auriculis subnudis, plantis ferè nudis, caudâ nigricante unicolore, truncum cum capite subæquante, metatarsis suprâ ex albido fusciscentibus. Long. tot. 7.50 poll.; caudæ 6.50; pedis 1.40; auriculæ 0.90.

Upper parts of a rich rusty-red, almost golden-rust, color along the sides; on the back obscured with considerable admixture of blackish hairs; the line of demarcation on the sides very sharp; the color of the upper parts (or a dusker hue) running down the outside of the legs to the wrists and ankles; the superior surfaces of the feet of most of the specimens white, clouded with dusky, sometimes the dusky strongly predominating, in other specimens, however, hardly or not appreciable. Extremity of muzzle colored; but, on the sides of the lip, the white reaching up to the roots of the whiskers, while just behind this the ferrugineous dips abruptly downward, so that the outline of the white and ferrugineous is far from a straight line. Below snowy-white;

the hairs white to the roots in the middle, but along the sides with ashy roots, somewhat obscuring the purity of the white. Tail nearly as long as the head and body together, at least exceeding the body alone, and blackish throughout, or so nearly unicolor that the under side is merely a shade paler than the upper. Whiskers very long, all jet-black at base, paler at ends. Soles very scant-haired back of the posterior tubercle; ears likewise nearly naked (both much as in *fuscipes*). General form and proportion of parts as in the other scaly-tailed *Neotomas*. Size averaging somewhat less than in *Neotoma floridana* (see table of measurements).

The fine series collected by Professor Sumichrast enables us to characterize this animal with precision. The five specimens vary but little, the difference being mainly in the purity and intensity of the colors; the metatarsus, however, in one specimen at least (9435), is white, whereas in all the others it is clouded with dusky. The animal is related to *N. fuscipes* in this respect, as also in the length and blackness of tail, but is smaller than that species, and otherwise distinguished at a glance by its rich rusty-red color, by which, furthermore, it is separated from any other of the rat-colored United States *Neotomas*.

The skull of No. 9507 has no structural peculiarities, but is smaller than any *adult* United States skulls examined; it measures 1.80 in length by 0.95 across the zygomata. The post-palatal notch may be rather narrow, but is not conspicuously so. The dentition affords us nothing diagnostic, as, in fact, is the case with all the rest of the genus; and we suspect that any peculiarity Mr. Tomes may have noticed in his types of *ferruginea* will prove only an individual feature, to be matched in other species.

We have not seen the young of this species, and do not know how gray it may be in youth; but we should expect that the dark gray or slate color of *floridana* and other northern species would not be perfectly exhibited in this case.

TABLE IV.—Measurements of five specimens of *NEOTOMA FERRUGINEA*.

Number.	Locality.	Collector.	Nose to—				Tail.	Fore foot.	Hind foot.	Ear.	Remarks.
			Eye.	Ear.	Occiput.	Tail.					
9379	Tehuantepec, Mexico.	F. Sumichrast.	0.75	1.65	1.83	7.00	6.50	0.70	1.35	0.85	Dry; adult.
9380	do	do	0.80	1.90	1.75	7.00	6.65	0.65	1.35	0.90	Dry; adult.
9381	do	do				7.85	7.00	0.78	1.40	0.87	Dry; adult.
9435	do	do				8.00	6.75	0.68	1.30		Dry; adult.
9507	do	do				7.75	6.75	0.75	1.45	0.90	Dry; adult.

## NEOTOMA CINEREA, (Ord) Baird.

## Bushy-tailed Wood Rat.

Ash-coloured rat, with hairy tail, of Rocky Mountains, LEWIS & CLARK, *passim*.

*Mus cinereus*, ORD, Guthrie's Geog. 2d Am. ed. ii, 1815, 292. (Based on the foregoing.)

*Neotoma cinerea*, BAIRD, M. N. A. 1857, 499, pl. liii, f. 4.—COUES, Proc. Acad. Nat. Sci. Phila. 1874, 175.

*Myoxus drummondii*, RICHARDSON, Zool. Journ. iii, 1828, 517.—WAGNER, Schreb. Säug. iv, pl. 227A.

*Neotoma drummondii*, RICHARDSON, F. B.-A. i, 1829, 137, pl. viii.—MAXIMILIAN, Reise, i, 1839, 365.—WAGNER, Suppl. Schreb. iii, 1843, 560.—AUD. & BACH, Q. N. A. i, 1849, 223, pl. xxix.—MAXIMILIAN, Arch. Naturg. xviii, 1862, p. —; Verz. N.-Am. Säug. 1862, 166.

*Neotoma occidentalis*, COOPER, MSS.—BAIRD, Proc. Acad. Nat. Sci. Phila. vii, 1855, 335; M. N. A. 1857, 496, pl. liii, f. 3.—COOPER & SUCKLEY, Nat. Hist. Wash. Terr. 1860, 128.

TABLE V.—Measurements of forty specimens of NEOTOMA CINEREA.

Number.	Locality.	Collector.	Nose to—				Tail to—				Remarks.
			Eyes.	Ear.	Occiput.	Tail.	Vent.	Hairs.	Anal fork.	Ear.	
4201	Fort Churchill, Hudson's Bay.	W. Mactavish	1.10	2.10	2.50	11.00	6.00	7.25	1.65	1.10	Dry.
8314	Saskatchewan River	J. McCauley	.....	.....	.....	9.50	5.75	7.75	1.55	.....	Dry.
7091	Fort Halket, Hud. Bay Ter.	J. Lockhart	.....	.....	.....	9.00	5.25	6.75	1.60	.....	Dry.
5667	Fort Liard, Hud. Bay Ter.	W. L. Hardisty	.....	.....	.....	9.50	.....	.....	.....	1.15	Dry.
5661	do	do	.....	.....	.....	10.75	6.00	7.25	1.65	.....	Dry.
5664	do	do	.....	.....	.....	9.00	4.75	6.00	1.00	.....	Dry.
5666	do	do	.....	.....	.....	6.00	5.50	6.25	1.65	1.00	Dry.
5663	do	do	.....	.....	.....	8.75	5.75	6.75	1.60	.....	Dry.
5662	do	do	.....	.....	.....	9.00	5.00	5.50	1.55	.....	Dry.
5670	—, Hudson's Bay Ter.	R. Campbell	.....	.....	.....	8.50	5.50	6.50	.....	.....	Dry.
.....	—, United States	—	1.00	1.00	2.10	8.25	6.00	7.00	1.53	1.00	Dry.
10616	Yellowstone River, Mont.	J. A. Allen	.....	.....	.....	.....	.....	.....	.....	.....	Dry.
10617	do	do	.....	.....	.....	.....	.....	.....	.....	.....	Dry.
224	Milk River	G. Suckley	.....	.....	.....	7.75	5.00	5.90	1.45	1.00	Dry.
1321	Fort Sarry, Neb.	F. V. Hayden	.....	.....	.....	7.00	4.00	4.50	1.40	0.90	Dry.
4330	Bighorn River, Neb.	G. H. Trook	.....	.....	.....	7.50	5.50	6.50	1.40	.....	Dry.
4302	Deer Creek, Neb.	do	1.10	2.00	2.25	10.00	6.50	7.75	1.85	1.15	Dry.
4307	do	F. V. Hayden	.....	.....	.....	9.00	.....	.....	1.55	1.08	Dry.
4308	do	do	.....	.....	.....	10.00	.....	.....	.....	.....	Dry.
3897	William's Springs, Utah.	C. S. McCarthy	.....	.....	.....	8.00	5.50	6.25	1.25	1.10	Dry.
3898	do	do	.....	.....	.....	6.50	.....	.....	1.19	.....	Dry.
3751	Pike's Peak, Colo.	D. C. Collier	.....	.....	.....	7.50	5.50	6.25	1.50	.....	Dry.
9294	Camp 19, Colo.	R. Ridgway	.....	.....	.....	7.50	.....	.....	1.45	.....	Dry.
9295	do	do	1.10	2.10	2.40	10.50	6.00	7.00	1.65	1.10	Dry.
3181	Fort Massachusetts, N. Mex.	D. C. Peters	.....	.....	.....	8.00	5.00	6.10	1.40	.....	Dry.
3758	do	E. C. Bowman	.....	.....	.....	8.50	6.25	7.25	1.50	.....	Dry.
3750	Fort Burgwyn, N. Mex.	W. W. Anderson	.....	.....	.....	8.75	5.25	6.10	1.50	.....	Dry.
9207	Straits of Fuca	G. Suckley	.....	2.38	.....	9.75	7.50	8.40	1.70	.....	Fresh.
8544	Washington Territory	J. G. Swan	.....	.....	.....	10.00	6.50	7.00	1.60	1.10	Dry.
8130	do	do	.....	.....	.....	.....	.....	.....	.....	.....	Dry.
462	Shoalwater Bay, W. T.	J. G. Cooper	.....	.....	.....	10.00	.....	6.50	1.75	.....	Fresh.
463	do	do	.....	.....	.....	9.00	.....	7.00	1.68	.....	Fresh.
573	do	do	.....	.....	.....	11.00	.....	8.50	1.85	.....	Fresh.
3806	Lake Depot, Utah.	C. B. R. Kennerly	.....	.....	.....	9.25	5.50	6.50	1.00	.....	Dry.
3753	Simlahmoo	J. Wayne	0.90	1.85	2.00	8.25	5.75	7.75	1.55	1.00	Dry.
89	Columbia River	J. K. Townsend	.....	.....	.....	10.00	.....	8.50	1.75	.....	Fresh.
968	Astoria, Oreg.	J. Wayne	.....	.....	.....	8.20	.....	6.70	1.75	.....	Fresh.
3318	do	do	.....	.....	.....	8.00	.....	5.50	1.00	.....	Dry.
3270	Fort Umpqua, Oreg.	E. P. Vollum	.....	.....	.....	8.50	7.00	8.00	1.65	.....	Dry.
4068	Fort Crook, Cal.	D. F. Parkinson	.....	.....	.....	7.00	5.00	5.75	.....	.....	Dry.

DIAGNOSIS.—*N. caudā hirsutissimā, (myoxina s. subsciurina), bicolorē, supra griseo-fusca, infrā alba; corpore suprā cinereo (luteo- s. badio- s. fusco-cinereo), infrā ex albido albo. Long. tot. circ. 9 poll., caudā circ. 6.00, pedis 1.40–1.75, auriculæ 1.*

HABITAT.—Western and Northwestern North America. Eastward to Hudson's Bay, Nebraska, and Colorado, &c. Southward to New Mexico and California. Westward to the Pacific.

Since both form and color come into play in consideration of the nominal species we shall presently discuss, we have at once inserted our table of measurements, after examining which we shall note the coloration of the animal, and then investigate the supposed *N. occidentalis*.

In size, this animal is rather the largest of the genus, averaging near the maximum of *floridana*. The only specimen that touches 11 inches is somewhat stretched; but as several others reach or exceed 10, 11 inches is probably not beyond a natural maximum. Only one (No. 3898) that seems by its coloration to be adult falls below 7 inches, and this one appears to be somewhat compressed in the make-up of the skin. We may safely deduce, therefore, striking off somewhat from both ends, an ordinary range of variation in length from 7.50 to 10.50 inches, with an average dimension of about 9 inches.

The tail, as usual, is still more variable; and as, moreover, it is badly stuffed in most of our specimens, the true dimension is hard to reach. We find, as the figures stand, the vertebræ running from 4.00 to 7.50 inches, and the hairs from 4.50 to 8.50. Cutting off 0.50 each way for probable error, even then there is left a range from 4.50 to 7.00 inches for the vertebræ, and from 5.00 to 8.00 for the hairs. This variation amounts to nearly 33 per cent. of the average length of the head and body. Excluding some of the more striking extremes in relative length of tail to body, we may safely say that the shortest normal length of tail to body would be about as in No. 5662, or No. 1321, where the proportion is as 5 : 9, or 4 : 7; 56 : 100 nearly, or but little over half the length of the head and body; while the longest relative length of tail is about as represented by No. 3270, where the tail is as 70 : 85, as 82 : 100, or four-fifths the head and body. But, since this animal (No. 3270) is supposed "*occidentalis*", we might here be accused of assuming in the premises what we wish to find in conclusion; so we will take another specimen, No. 3758, from New Mexico, being typical "*cinerea*"

Here the figures are 6.25 to 8.50, or nearly as 75 : 100; that is, the tail is about *three-fourths* the length of the head and body, at any rate. But, to be fair to ourselves, we will take one other, No. 3806, a typical "*occidentalis*;" here the figures are 5.50 : 9.25, or about 59 : 100; that is, considerably under two-thirds the length of the head and body.

In other words: throughout the whole series, the tail (*vertebræ*) ranges from about half as long to about four-fifths as long as head and body; in the series of true *cinerea* alone, the tail ranges from about one-half to about three-fourths as long; in the series of "*occidentalis*", so called, the tail ranges from less than two-thirds to about four-fifths as long; and the respective ranges of the two series overlap each other by about as much as they differ from each other. Throughout, the variation is by insensible degrees; there is no break in the series. Obviously, therefore, the characters "*caudal vertebræ* about as long as the trunk", as opposed to "*caudal vertebræ* considerably shorter than the trunk" (*Baird, op. cit.* 487), fail to be diagnostic of two species.

The average tail is about two-thirds as long as the average body.

Excluding No. 3898, which seems to be an abnormally small individual if really adult, as it appears, the hind feet range from 1.40 to 1.85 in length, a more customary range being 1.45 to 1.75; and the average settles very nearly at 1.66 inches. The fore feet (not given in the table) are about one-third of an inch long.

The ears, measured from the notch in front, average a little over an inch in length, ranging from 0.90 to 1.15.

The whiskers are immensely long—the longest ones averaging nearly 4 inches. An idea of their length will be gained when we say that in one specimen the distance between the tips of the outstretched whiskers is *over eight inches*.

The densely hairy tail of this animal, unique in the genus, early attracted attention. The average tail is haired almost exactly as in *Myoxus*; the hairs increase in length, usually, from base to tip, and likewise, as in *Myoxus glis*, are more or less distichous in arrangement, so that the tail is flattened. In some of the more heavily-haired tails, the resemblance to *Tamias* is striking; and the hairiest of all even approach the condition of *Sciurus* itself, although the shape is subterete rather than perfectly distichous. Thus, in No. 8314, the hairs, pressed out flat, measure *fully three inches across*, and the terminal

ones form a brush *two inches* beyond the end of the vertebrae. This maximum of hairiness, however, is rarely if ever seen, except in boreal specimens: the most heavily-haired United States tails are only about two inches across; an average one is rather less than this; the average pencil at the end is probably not over one inch. There is a great difference, also, according to season. In the spring, when the animal has just lost its heavy winter-coat; and in summer, before it has commenced to put on its protection from the cold, the tail may be only a little more hairy than in Kansas samples of *N. floridana*. Thus, in Nos. 3897, 3898, 9324, &c., the hairs are much less than an inch across, along most of the tail; and this member looks precisely as figured by Audubon. Comparison of Audubon's with Richardson's plates will give an excellent idea of the extreme differences; both these figures are faithful, and can be precisely matched in our series. It is hardly necessary to add that, nevertheless, the tail is never so scant-haired as to permit the annuli to be seen.

The ears, and to some extent the feet, share the general increase of hairiness over *floridana* that the tail shows. The ears are, in general, closely and softly pilous, much like a squirrel's; never so nearly naked as in *floridana*, &c. In United States specimens, there is not much difference in this respect; but, in the arctic ones, this soft pilous state becomes actually hirsute. In all the specimens, the heels are closely hairy to the posterior tubercle; in arctic ones, the hairiness is more dense, and even encroaches on the sole from the sides. The hairs on the upper surfaces of the toes generally reach about to the ends of the nails; in arctic examples, they are longer, completely hiding the claws. The palms are always completely naked from the posterior tubercles. The tubercles are five in number: two abreast, posterior; two abreast at base of 5th and 2d toes, respectively; one intermediate between these last and a little anterior to them at conjoined bases of 3d and 4th digits. The very rudimentary 1st digit looks exactly like an additional tubercle at the antero-internal corner of the inner posterior one. The soles have six tubercles, with the ordinary disposition; the posterior one of these is subcircular (not linear, as in *Mus*, &c.).

Aside from *seasonal* conditions, which, being well known, and the same as in other rodents, need not be here particularized, the pelage varies in the series as follows: The arctic skins are very full-haired and soft; the United States prairie-region skins are equally soft, if not more so, but not so full;

while the Pacific-coast forest-specimens have a rather coarser and harsher fur. This character, too, has entered into a specific diagnosis; yet, although the point cannot be reduced to figures and proven mathematically, we declare that it is impossible to draw a dividing line between these conditions.

The under parts of this animal are white—usually snowy-white in United States prairie skins, and dull soiled white, or even ashy-white, in Arctic and Pacific coast specimens. The remark just made applies here with undiminished force.

The upper parts correspond with the under. In the prairie skins, the color is very bright; a rich fawn or luteous-brown, lined with black on the back. In all the Arctic ones, and likewise in the Pacific-coast ones, the shades are much darker, more inclining to ordinary rat-color, but always with more or less of a clayey-brown or rusty-gray. Young animals from these regions, respectively, are dull pale gray and deep slate-gray. One specimen (No 3318), apparently a sickly or otherwise abnormal example, is rusty-red underneath. But all these various shades of color are so inextricably mixed, that it is out of the question to base a specific character upon them.

It is interesting to observe, in this connection, that the tail does not seem to share this variation in color. In the tawniest prairie skins, as in the rest, the tail is ashy-gray above, white below. Sometimes, indeed, the tail is paler, or even a little browner, than in other cases; but it is essentially *gray* in all cases—discolor with the back in the rusty skins, concolor with the back in the dark ones.

We are pleased to notice in this animal the strongest possible confirmation of the views reached in our discussion of various supposed species of *Hesperomys*, concerning geographical strains. We solve the whole *Neotoma* question in a nutshell, when we say that it is parallel with the case of *Hesperomys* "austerus" as far as dark color and length of tail of *N. "occidentalis"* are concerned; and with the "nebrascensis" style of "sonoriensis" as far as color is concerned. We may, in a rude way, throw the *Neotoma* skins before us into three heaps: first, the Arctic ones, thickly clad, short-tailed, dark-colored; secondly, the United States prairie ones, thinly clad, short-tailed, bright-colored; thirdly, the Pacific-coast ones, medium clad, long-tailed, dark-colored. If there be more than one "species", there certainly are *three*; and granting, for a moment, that there are two, the Arctic ones, of course the true *N. drummondii*, look much more like the Pacific-coast ones than they do like the

tawny Nebraska ones. Professor Baird, with no examples of Arctic *Neotoma* (the original *drummondii*) before him, saw the differences between the short-tailed ones Richardson described and the long-tailed ones given by Audubon as "*drummondii*"; and then receiving two short-tailed ones from Nebraska (Suckley's and Hayden's first skins), he concluded that these must be the real *drummondii*, and adopted Cooper's name *occidentalis* for the Washington and Oregon series. The bright colors and soft fur of the Nebraskan ones, really somewhat different from the darker and harsher pelage of the others, confirmed his erroneous impression. But those who may desire to push specific differentiation further than we are willing to, must recognize *three* species as above indicated, or else indorse the view that there is but one.

#### NEOTOMA MAGISTER, Baird.

##### Fossil *Neotoma*.

*Neotoma magister*, BAIRD, M. N. A. 1857, 498 (in text).—COUES, Proc. Acad. Nat. Sci. Phila. 1874, 175.

*Locality of remains*.—Caves of Pennsylvania, near Harrisburg and Carlisle.

This species is based upon a number of under jaws gathered in the above-mentioned places. These differ from the same bones of the existing species in averaging rather larger; but the difference is not decided. Thus, No. 12207 is precisely the size of No. 6883 (*N. cinerea*). The teeth show no appreciable peculiarities: we have them in various stages of wear, all of which can be matched in our series of recent specimens; and the same is true of the shape of the several parts of the jaw. As far as these fragmentary witnesses go, we cannot determine *N. magister* to be anything more than a former condition of one of the existing species—probably *floridana*; but as we have it separated by a considerable lapse of time, and have no assurance that it was not quite different in color, or in the proportions of the limbs, ears, tail, &c., the expediency of retaining the name is evident.

With this case in hand, we offer an hypothesis that is none the less reasonable for being presumptive. *Neotoma magister* was the original species at the time the genus was differentiated from the then coëxistent types of Murines, and became the progenitor of the four kinds ("species") of *Neotoma* living in America to-day. Those individuals that remained at and about the locality of the parent stock have varied the least, and present the assemblage of characters we call *N. "floridana"*. Other individuals, migrating westward, met, in the regions now known as Colorado, Kansas, &c., physical



influences resulting in the slight\* differences in the color and texture of the pelage. The northward emigration from this point assumed, probably through the influence of thermometric conditions, the longer fur and especially the dusky tail of the now *N. "cinerea"*; this attaining its maximum in the Arctic regions. Secondary, slighter differentiations of this branch, due to hygrometric conditions, resulted in the light-colored variety from the dry plains ("*cinerea*" of Baird), and the dark variety from the wet, wooded region of Oregon and Washington Territories; in the Arctic regions the color being intermediate, though the pelage is at an extreme of length and density as a protection from cold. Other westward migrants from the Kansas and Colorado center, encountered in the vicinity of Fort Tejon influences that developed *N. fuscipes*. What these were, we have no idea; but they are obviously the same that there remodeled *Hesperomys leucopus* into *H. californicus*, and made *Ochetodon longicauda* out of *O. humilis*. The southward emigration from the same center, like the northward one, gives results in perfect accord with established and recognized laws. All are smaller, yet with increase in the relative size of peripheral parts; the comparative dimensions of the tail, feet, and ears being greater. In the New Mexican and Arizonan deserts, warmth and dryness effected the much paler and slightly smaller variety known as *N. mexicana*; while still farther south, the greater heat, with less dryness, culminated in the much smaller and very much richer-colored *N. ferruginea*. In this enumeration, we omit *N. "micropus"*, which rests upon intangible characters, and these even not shown to be permanent. However sound this theory may be, or the reverse, it will, we think, be admitted that it explains every phase *Neotoma* has assumed since the days of *N. magister*, in strict accordance with laws of geographical variation, the general applicability of which no one can intelligently question.

We have only to add a word here, since we can explain our usage of specific names very perfectly with this case in illustration. So far from believing that any of our *Neotomas* represent different "species" in the former acceptation of the term, we hold that they are all one, bearing to each other the simple relation of parent and offspring. But we write *Neotoma floridana*, *N. fuscipes*, *N. cinerea*, and *N. ferruginea*, because these words severally express definite, tangible, and (comparatively speaking) constant characters which have been impressed upon the parent stem by the physical influences above mentioned

\* Cf. our remarks upon the difficulty of distinguishing some examples of *N. cinerea* and *floridana* from this region.

or alluded to; these characters appearing the more strongly, because, in the course of time, the intermediate connecting stages of change have become effaced. On the other hand, we discard the names *occidentalis*, *mexicana*, and *micropus*, because these terms express indefinite, more or less intangible, and fluctuating phases of development, which are of less importance, since the links that bind the forms to their respective branches of *Neotoma* are perfectly plain. Moreover, the first-named species all rest upon very broad—primary, so to speak—geographical, and therefore climatic, conditions; while the last-named indicate only the operation of restricted local influences.

### GENUS SIGMODON, Say & Ord.

*Sigmodon*, SAY & ORD, Journ. Acad. Nat. Sci. Phila. iv, 1825, 352.—AUD. & BACH., Q. N. A. I, 1849, 227.—BAIRD, M. N. A. 1857, 501.—COUES, Proc. Acad. Nat. Sci. Phila. 1874, 175; and of authors generally.

*Arvicola*, sp., AUD. & BACH.; HARLAN; GODMAN.

*Hesperomys (Deltomys)*, sp., DE SAUSSURE, Rev. & Mag. Zool. 1860. ("S. toltecus".)

**CHARS.**—Skull and dentition much as in the sigmodont *Mures* at large. Length of skull less than twice the width of the widely divergent zygomata; these arches set very obliquely to the axis of the skull, and not dipping down to the level of the palate. Plate of maxillary forming the outer wall of the anteorbital foramen with a concave front border, because of a prominent process that nearly divides the lower slit-like aperture of the foramen from the upper oval part. A prominent raised bead at the supraorbital border, running thence backward obliquely outward on the temples to the occiput. Palate ending behind, opposite the posterior border of the last molars, with a slight emargination divided in two by an azygos median process of bone, and excavated on each side of this, with a minute foramen at the bottom of the excavation behind. Incisive foramina long. Tympanic bullæ comparatively small. Jaw with the coronoid process overtopping the condyle; the root of the under incisor forming a protuberance on its outside near the notch between condyle and coronoid. Descending process rather large and flat, with incurved under border. Pelage hispid, from abundance of large bristly hairs. General form stout, somewhat arvicoline. Profile of head strongly convex; muzzle short, obtuse, hairy, except the nasal pad. Tail from two-thirds to three-fourths as long as the head and body; generally less than the body alone. Ears large, orbicular, sub-naked outside, hirsute inside. Antitragus well developed, valvular. Fore feet small, not half as long as the hinder; palms naked, 5-tuberculate (two large tubercles abreast, posterior, one at base of 2d and 5th fingers respectively, one at base of 3d and 4th together); thumb rudimentary, with an obtuse, flat-

tened nail. Hind feet very long, generally about equaling distance from nose to ear; 1st and 5th toes subequal and very short, the latter reaching but little beyond the basal joint of the 4th. Soles entirely naked, granular at bases of toes, perfectly smooth behind, 6-tuberculate, the tubercles all small, the hindermost not lengthened and linear as in *Mus*; the 2d tubercle just outside and a little in advance of this one; a tubercle just inside the base of the 1st and 5th toes respectively; one between bases of 2d and 3d toes; one between bases of 3d and 4th toes.

Although this form of sigmodont *Murina* is undoubtedly strongly marked, yet we cannot see that it stands apart from the rest so far as it is tacitly supposed to. A good deal that has been written about its peculiarities of dentition might be advantageously toned down; in fact, we do not find much, if any, greater dental characteristics than those slightly superspecific ones marking several other forms usually ranked as subgenera of *Hesperomys*. The loops of enamel on the posterior molars do form a sort of sigma, but it is usually a broken and always a distorted one, never more evident than in some other sigmodont forms. The pattern of the teeth is fully as changeable with age as it is in *Hesperomys*, *Neotoma*, *Mus*, and other genera; and it is only to a particular stage of the crowns that the details of pattern, usually ascribed to the genus, hold good. Moreover, we have, in the section *Oryzomys*, a perfect link between *Sigmodon* and the ordinary small *Hesperomys* of America. The connection is so close and complete, that, in fact, we should almost think *Oryzomys* ought to take place as a subgenus of *Sigmodon* rather than of *Hesperomys*; or, if retained where it is now, *Sigmodon* ought to be laid over against it as another subgenus of *Hesperomys*. In external characters, *Oryzomys* agrees better with *Sigmodon* than it does with ordinary *Hesperomys*; the two are so much alike, in fact, that the relative length of the toes and the comparative size of the ears are the most readily-expressed differences. We are not sufficiently familiar with all the exotic American *Murina* to come to a final conclusion; but we suspect that it will in time be found advisable or necessary to combine most of the species of the sigmodont *Mures* into one genus (for which the name *Sigmodon*, antedating *Hesperomys*, would have to be adopted), with several subgenera or groups of species; for, with the exception of *Neotoma*, perhaps *Holochilus*, and possibly one or two others, the various superspecific groups seem to differ from each other by characters of about equal or equivalent value. The impropriety is, that it is at present customary to hold some of these groups for genera, others only for subgenera;

whereas they do not appear to afford grounds for any such subordination. Thus, *Onychomys* seems to us fully as different from *Hesperomys* proper as *Sigmodon* is; and we should judge the same to be the case with such forms as *Abrothrix* and *Oxymycterus*. But as we are not now undertaking a critical revision of the whole sigmodont tribe, we prefer to accept the groups as we find them, provided they are established with any considerable show of reason, rather than present decided innovations; and for the present, in order to bring out the groups in the strongest relief, we accord generic rank to some that probably we should reduce to subgenera upon final survey of the whole.

The principal diagnostic points of the skull of *Sigmodon* are those mentioned in a preceding paragraph. The shortness of the skull, in comparison with the great width, resulting from the widely divergent zygomata; the short, swollen, rostral portion; the arched frontal profile; the curious little pointed process of the lamellar plate of the maxillary that bounds the foramen (wanting in other groups we have examined—even in *Oryzomys*); the position and peculiar sculpture of the palatal shelf; the small bullæ osseæ; the bead on the orbital edges,—all are strong characters, in peculiar combination. We might easily describe several additional, more minute features, but this seems unnecessary. The following table shows the size, proportions, and variations of the skull of the single species of the genus we have examined.

TABLE VI.—Measurements of fourteen skulls of species of SIGMODON.

Number.	Locality.	Length.	Height.	Zygomatic width.	Interorbital width.	Length of nasal bones.	Upper incisors.	Coronoid to incisors.	Condyle to incisors.	Under incisors.	Molar series.	Remarks.
4763	Georgia.....	1.37	0.50	0.80	0.30	0.55	0.94	0.75	0.93	0.37	0.96	<i>Atepidus</i> , adult.
4764	...do.....	1.97	0.57	0.73	0.18	0.40	0.93	0.60	0.83	0.33	0.90	<i>Atepidus</i> , adult.
1075	...do.....	1.40	0.54	0.82	0.31	0.75	0.95	0.95	0.95	0.38	0.95	<i>Atepidus</i> , adult.
10150	...do.....	1.80	0.50	.....	0.30	0.45	0.94	0.70	0.80	0.30	0.95	<i>Atepidus</i> , adult.
9080	South Carolina.....	.....	.....	.....	.....	.....	.....	0.70	0.92	0.34	0.93	<i>Atepidus</i> , adult.
1935	Florida.....	.....	.....	.....	0.30	0.40	0.17	0.67	0.78	0.34	0.90	<i>Atepidus</i> , adult.
19147	Mohave Valley, Cal.....	1.30	0.53	0.75	0.30	0.50	.....	0.73	0.90	0.34	0.95	<i>Atepidus</i> , adult.
12146	...do.....	.....	0.77	0.80	0.50	0.94	.....	.....	.....	.....	0.99	<i>Atepidus</i> , adult.
1067	Conchula, Mexico.....	.....	0.78	0.19	0.50	0.96	0.70	0.88	0.30	0.95	.....	"berlandieri."
19151	Matamoros, Mexico.....	1.15	.....	0.19	0.44	0.15	0.68	0.75	0.30	0.93	.....	"berlandieri."
9071	Tehuantepec, Mexico ..	1.40	0.74	0.75	0.30	0.57	0.94	0.78	0.90	0.33	0.95	"berlandieri."
9070	...do.....	1.97	0.49	0.90	0.30	0.50	0.93	0.69	0.84	0.32	0.94	"berlandieri."
9073	...do.....	1.80	0.48	0.70	0.19	0.45	0.19	0.60	0.77	0.30	0.91	"berlandieri", youngish.
7810	Orizaba, Mexico.....	1.15	.....	0.70	0.18	0.40	0.19	0.60	0.77	0.30	0.90	"tolmense", youngish.

**Dentition.**—Selecting an average adult example, as No. 4763, in which the teeth are full-grown, yet not so worn as to deface the pattern, we find as

follows:—The upper molars have three roots each: a large interior fang, and two smaller exterior fangs, placed side by side; but the anterior of these, in the *first* molar, is as large as the interior, and stands directly to the front, instead of to the outside, while this same tooth also often shows a fourth root—a small one interposed between the two exterior ones. But the under molar roots show us something that may be peculiar—at least, we have not observed it in other genera; this is, that they have more than two roots apiece, and the disproportion in size of the roots is very great. The front lower molar has four fangs: a moderate anterior fang; an enormous posterior fang; and two little intermediate fangs, placed side by side. The next two under molars have each three roots: two small anterior ones placed side by side, and one enormous posterior fang. The larger fangs seem to result from the confluence of two small ones; and, in both upper and under teeth, there are sometimes minute accessory fangs that do not effect a distinct perforation of the alveolus, and are, therefore, not enumerated. We think it very likely that this mode of rooting may be really characteristic of *Sigmodon*, but have not ventured to include it in our diagnosis, in our uncertainty as to its permanence, and our ignorance of what, if any, other sections may show the same thing. The front upper molar is larger than the other two; but these are of about the same size, since, contrary to a general rule, the back molar does not diminish in bulk. All three have externally two deep reëntrant lobes, or folds, of enamel, reaching almost across the face of the teeth; the front upper molar has two similar interior folds; the other two but one such interior loop apiece. In the front molar, the first exterior loop abuts against the second interior loop, or else is received in the space between the first and second interior loops; similarly, on the other teeth, the first exterior loop abuts against the only interior loop, while, in all three teeth, the second exterior loop abuts against the postero-internal angle of the general enamel-wall. The abutment of these folds is more or less perfect with different specimens, but, generally, it divides the enamel-area into several dentine islands. In the under jaw, likewise, the molars do not decrease in length from before backward, the back molar being as long as the first, and, if anything, even broader; still, the complexity of the crown is much greater on the first than on either of the others. The first lower molar shows three interior and two exterior reëntrant folds of enamel, alternating with each other; the apex of each fold is received against the apex of the next succeeding, so that the face of the tooth is

divided into *five* separate dentine islands (when the abutment is perfect). The nicks in the border of the tooth between these folds are more open than in any of the other teeth; in fact, approaching the open reëntrances of *Neotoma*. The two last under molars differ much from the first, and are almost precisely like each other; they have usually but one perfect reëntrant loop on both inside and outside, and, as these loops alternate, an appearance something like the letter S is produced. But the imperfection, and especially the inconsistency of this pattern, has been already mentioned, and is further shown below. Often, in case of the middle lower molar, there is another imperfect loop, either internal or external—or two such, one external, one internal; these we have not noticed on the back tooth, where the "sigma" is best shown.

The teeth of the Mexican skulls before us, including *S. "toltecus"*, offer nothing noticeably different from the ordinary style. M. De Saussure figures (*l. c.* pl. ix, f. 3\*) an average example—perhaps rather elderly, however. Our No. 7510 is still older, showing many of the reëntrant folds dis severed from the surrounding wall, and forming conspicuous islands in the dentine area.

The teeth of an aged *Sigmodon* (No. 2972, South Carolina) show conclusively that the progressive changes of the molar crowns are as described in *Vesperimus*, although *Sigmodon*, like *Neotoma*, loses its tubercles so early that we have not observed the primitive unworn condition. The senile condition that the molars of this specimen have reached may be said, in a word, to be the penultimate one, in which the reëntrant loops of enamel, though still evident, are nearly severed from their connection with the general envelope—the peninsulas are almost islands in some places, in others have become quite isolated. These molars are nearly worn down to the roots. The only further change of which they would have been susceptible had the animal lived, is the final rubbing out of these islands, when the teeth would have presented a single continuous depressed dentine area, irregularly bounded by the external sheet of enamel. The front upper molar shows two external and two internal in-lying folds; the former still perfectly peninsular, the latter almost isolated. The middle shows one perfect internal peninsula and two external folds; the anterior one of which is already insular, the posterior nearly so. The back upper molar is in the same condition as the middle one. The front under molar shows two internal peninsulas alternating with an external peninsula and an external island. Both the other under molars show one external peninsula; on the middle one the internal loop has become insular, while on the last one the same loop remains peninsular.

## SIGMODON HISPIDUS, Say &amp; Ord.

## Cotton Rat.

- Sigmodon hispidus*, SAY & ORD, Journ. Acad. Nat. Sci. Phila. iv, 1825, 354, pl. x, f. 5, 6, 7, 8; Zool. Journ. ii, 1825, 296, pl. x, f. 5, 6, 7, 8.—WAGNER, Suppl. Schreb. iii, 1843, 556.—AUD. & BACH., Q. N. A. i, 1849, 229, pl. xxx.—BAIRD, M. N. A. 1837, 502.—ALLEN, Bull. Mus. Comp. Zool. ii, 1871, 183.—COUES, Proc. Acad. Nat. Sci. Phila. 1874, 176.
- Arvicola hispidus*, GODMAN, Am. Nat. Hist. ii, 1826, 68.
- Arvicola horiensis*, HARLAN, Fn. Amer. 1825, 138; Med. & Phys. Res. 1835, 40, pl. —, f. 5, 6, 7, 8.—GRIFFITH, Anim. Kingd. v, 1827, sp. 547.
- Arvicola ferruginea*, HARLAN, Am. Journ. Sci. x, 1823, 285 (rusty var.).
- Arvicola texiana*, AUD. & BACH., Q. N. A. iii, 1853, 220, pl. cxlvii, f. 2 (not *Arvicola texana*, AUD. & BACH., *ibid.* p. 319, which is *Hesperomys leucopus*).
- Sigmodon berlandieri*, BAIRD, Proc. Acad. Nat. Sci. Phila. vii, 1855, 333; M. N. A. 1837, 504; U. S. & Mex. Bound. Surv. ii, 1859, Mammals, p. 44, pl. vi, f. 2, 2<sup>a</sup> (Texas; Mexico).—TOMES, Proc. Zool. Soc. 1861, 281 (Guatemala).
- Hesperomys (Dilemys) toltecus*, DE SAUSSURE, Rev. & Mag. Zool. 1860, p. —, pl. ix, fig. 3<sup>a</sup> (Cordilleras of Vera Cruz).

DIAGNOSIS.—*S. caudâ subnudâ truncum sine capite subaequante; pedibus validis, digito 5<sup>to</sup> vix 1<sup>mm</sup> superante, nec valde ultra articulum proximum 4<sup>th</sup> porrecto; plantis nudis, tessellatis, 6-tuberculatis; auriculis magnis orbiculatis, intus hirsutis extus subnudis; rostro obtuso, piloso (septo narium excepto); mystaceis sparsis brevissimis; vellere hispido; supra nigro badique intime limbatus; infra ex griseo albidus, pedibus dorso concoloribus, caudâ sub-bicolor.*

HABITAT.—Southern United States and Mexico, especially coastwise. North to the Carolinas. South to Vera Cruz and Guatemala.

A sigmodont rat, with a nearly naked tail about equaling the trunk without the head (from a little less than the trunk alone to about the length of the trunk and head together); large hind feet, of which the 1st and 5th toes are but little unequal in length, the latter reaching but little beyond the base of the 4th (never to the penultimate joint of the 4th); entirely naked granulated soles, with six small tubercles; large rounded ears, hairy inside, nearly naked outside; blunt muzzle, furry except at the septum, and very few whiskers hardly reaching to the ears; the pelage long and hispid, from admixture of much bristly hair, finely lined above with black and brownish-yellow, below grayish-white; feet not white above, and black below; tail very indistinctly bicolor.

It will probably be admitted that the foregoing diagnosis is tolerably stringent and reasonably specific; yet we propose to prove it comprehensive enough to include several nominal species.

It is unnecessary to go into any elaborate description of this familiar animal, viewing the several excellent accounts already in print, and especially since the essential characters have been fully elucidated in our notice of the

genus. In entering at once upon the discussion of the nominal species that have been coined at the expense of *Sigmodon hispidus*, we first present a table of measurements of thirty-four specimens collected in the same locality by the same persons. A part of the measurements being from alcoholic specimens and the rest from very nicely-prepared skins, the figures are reliable. They serve to indicate the normal individual variability of the animal in size, unaffected by geographical or climatic influences, and give us data in the problem that cannot be gainsayed.

TABLE VII.—Measurements of thirty-four specimens of SIGMODON HISPIDUS from Society Hill, South Carolina, collected in 1855-56 by Rev. M. A. Curtis and sons.

Number.	Nose to—				Tail.	Palm.	Sole.	Ear.	Remarks.
	Eye.	Ear.	Occiput.	Tail.					
2983	0.70	1.45	1.67	5.45	3.75	0.62	1.25	0.70	Alcoholic; copied from Baird.
2984	0.60	1.25	1.46	4.75	3.25	0.60	1.15	0.60	Alcoholic; copied from Baird.
2985	0.60	1.25	1.42	4.65	3.20	0.58	1.15	0.60	Alcoholic; copied from Baird.
2986	0.65	1.30	1.47	4.90	3.40	0.61	1.20	0.70	Alcoholic; copied from Baird.
2987	0.65	1.30	1.43	4.80	3.45	0.60	1.20	0.70	Alcoholic; copied from Baird.
2988	0.66	1.30	1.55	5.05	3.30	0.63	1.20	0.65	Alcoholic; copied from Baird.
2989	0.60	1.25	1.46	4.90	3.25	0.55	1.17	0.60	Dry.
2990	0.65	1.30	1.50	4.80	3.35	0.56	1.20	0.70	Dry.
2991	0.70	1.45	1.60	5.90	3.75	0.60	1.25	0.75	Dry.
2992	0.65	1.35	1.50	5.05	3.30	0.60	1.20	0.60	Dry.
2993	0.62	1.30	1.45	4.50	2.25	0.58	1.20	0.70	Dry.
1999	0.65	1.25	1.40	5.25	3.50	.....	1.17	0.65	Dry.
1991	0.65	1.25	1.45	5.25	3.50	.....	1.15	0.60	Dry.
1988	0.60	1.40	1.65	5.50	3.50	.....	1.20	0.62	Dry.
1989	0.62	1.42	1.50	5.25	3.00	.....	1.10	0.62	Dry.
1987	0.65	1.30	1.40	4.50	2.75	.....	1.10	0.68	Dry.
1985	0.62	1.15	1.40	5.00	3.10	.....	1.15	0.70	Dry.
1983	0.60	1.25	1.35	4.25	3.00	.....	1.10	0.66	Dry.
1992	0.70	1.45	1.60	5.00	3.20	.....	1.10	0.65	Dry.
1237	0.60	1.20	1.30	4.10	3.10	.....	1.10	0.60	Dry.
1238	0.70	1.40	1.67	5.75	3.20	.....	1.20	0.70	Dry.
1230	0.65	1.40	1.60	5.25	3.60	.....	1.22	0.67	Dry.
1241	0.57	1.10	1.25	4.00	2.75	.....	1.05	0.57	Dry.
1242	0.60	1.40	1.65	6.00	3.20	.....	1.30	0.65	Dry.
1240	0.64	1.20	1.45	5.00	3.50	.....	1.12	0.63	Dry.
1243	0.68	1.25	1.55	4.90	3.40	.....	1.15	0.64	Dry.
1245	0.60	1.15	1.35	4.40	3.00	.....	1.10	0.55	Dry.
1246	0.61	1.20	1.30	4.80	3.10	.....	1.12	0.60	Dry.
1244	0.66	1.35	1.50	5.75	3.75	.....	1.25	0.67	Dry.
1303	.....	.....	.....	4.00	2.50	.....	1.00	.....	Dry.
1304	.....	.....	.....	4.00	2.50	.....	1.05	.....	Dry.
1306	.....	.....	.....	4.40	2.70	.....	1.05	.....	Dry.
1307	.....	.....	.....	4.50	2.40	.....	1.03	.....	Dry.
979	.....	.....	.....	6.00	3.20	.....	1.20	.....	Dry.



The animal varies from 4 to 6 inches in length of head and body; but neither of these extremes is ordinarily reached. The average length settles at very nearly 5 inches. The variation is 50 per cent. of the minimum, and 33 per cent. of the maximum.

The length of tail ranges from 2.25 to 3.90 inches. These appear to be exceptional figures, however; and to be within safe limits, we will take 2.50 and 3.75 as ordinary extremes; the variation 1.25, exactly the same percentage as that of the body. The average tail stands hard upon 3 inches.

The ear (measured from the notch in front) runs from 0.55 to 0.75, settling at about 0.66, or two-thirds of an inch, in height. This dimension is substantially the same as the distance from nose to eye. The limits of variation accord in their percentage with those already found for trunk and tail. The fore paws (measured from the wrist) are a little below this dimension (about 0.60); their variability is about the same.

The hind feet run from 1.00 to 1.30 inches as extremes; more frequently from 1.10 to 1.25, settling near 1.15 as an average. This dimension averages a little less than the distance from nose to ear.

The head is about 1.50 inches long, but runs from 1.25 to 1.66.

The ratio of tail to head and body is this: No. 979, 3.20 to 6.00, or tail little over half the length of the head and body; No. 1237, 3.10 to 4.10, tail only an inch shorter than head and body, about three-fourths the head and body. The average tail (3.00 +) is to the average body (5.00 —) about as 0.66 is to 1.00; that is, it is about two-thirds as long.

The coloration of this series is remarkably constant; in fact, we see nothing that calls for special comment. Some of the specimens are a little darker or a little paler, from presence of more or fewer black hairs above; and some are quite pure white underneath; others grayer; others again of a pale muddy-brownish; but these variations are not at all striking.

We next insert a table of specimens of *Sigmodon* from Carolina to Southern Mexico. They embrace the type of *S.* "berlandieri" and all Baird's other specimens of that supposed species; typical examples of "*Hesperomys* (*Deilemys*) *toltecus*", De Saussure; rusty individuals agreeing with "*Arvicola* *ferrugineus*", Harlan; LeConte's, Audubon's, and Bachman's samples, &c.

TABLE VIII.—Measurements of thirty-nine specimens of SIGMODON from the Southern United States and Mexico.

Number.	Locality.	Collector.	Nose to—				Tail.	Palm.	Sole.	Ear.	Remarks.
			Eyo.	Ear.	Cer- pit.	Tail.					
33	South Carolina.....	J. Bachman.....	0.60	1.10	1.35	4.50	0.75	0.54	1.07	0.55	Dry.
7047	Georgia.....	Lambe College.....	.....	.....	.....	5.75	4.50	.....	1.15	.....	Dry.
90	do.....	J. LeConte.....	0.69	1.20	1.30	4.75	3.60	0.54	1.18	0.65	Dry.
34*	do.....	do.....	0.75	1.30	1.66	5.50	3.35	0.60	1.29	0.63	Dry.
4823	do.....	J. Postell.....	0.60	1.40	1.80	6.25	3.75	0.50	1.25	0.70	Alcoholic.
4833	do.....	do.....	0.70	1.25	1.40	5.75	3.25	0.50	1.15	0.68	Alcoholic.
381	do.....	J. J. Audubon.....	0.75	1.50	1.75	5.60	3.25	0.55	1.50	0.60	Dry.
4815	do.....	Dr. Geaner.....	0.70	1.30	1.60	5.00	3.75	0.55	1.24	0.67	Alcoholic.
3701	do.....	S. W. Wilson.....	.....	.....	.....	.....	.....	.....	1.30	.....	Alcoholic.
2025	do.....	do.....	.....	.....	.....	.....	.....	.....	1.30	.....	Dry.
9088	do.....	do.....	.....	.....	.....	5.50	3.40	.....	1.12	.....	Alcoholic.
909	Florida.....	G. Wurdemann.....	.....	.....	.....	.....	.....	.....	1.07	.....	Dry.
9250	Fort Cobb.....	E. Palmer.....	0.65	1.20	1.40	5.75	3.60	0.55	1.20	0.65	Dry.
3378	Texas.....	L. C. Eivendberg.....	.....	.....	.....	5.00	3.50	.....	1.22	.....	Dry.
9091	do.....	G. Lincoam.....	.....	.....	.....	5.50	3.75	0.56	1.10	0.65	Dry.
9092	do.....	do.....	.....	.....	.....	6.00	3.50	0.55	1.50	0.70	Dry; stretched.
9093	do.....	do.....	.....	.....	.....	5.00	3.30	0.55	1.15	0.70	Dry.
8820	do.....	H. B. Butcher.....	0.80	1.50	1.60	7.00	4.30	.....	1.20	.....	Dry; much stretched.
232	do.....	J. H. Clark.....	0.60	.....	.....	.....	.....	.....	1.14	0.69	Dry.
8	do.....	do.....	.....	.....	.....	7.00	4.00	.....	1.17	0.60	Dry; much stretched.
9092	do.....	A. Schott.....	0.65	1.30	1.45	5.65	2.95	0.54	1.18	0.70	Alcoholic.
4977	California.....	J. C. Ives.....	.....	.....	.....	6.00	4.00	0.60	1.40	0.75	Alcoholic.
4977	do.....	do.....	.....	.....	.....	5.50	3.60	0.55	1.25	0.70	Alcoholic.
2681	Matamoros, Mex.....	Dr. Berlandier.....	0.55	1.18	1.38	4.50	2.40	0.50	1.15	0.70	Alcoholic.
5061	Cosahuila, Mex.....	D. N. Couch.....	0.70	1.50	1.67	5.67	4.60	0.60	1.90	0.60	Dry.
304	Nuevo Leon, Mex.....	do.....	.....	.....	.....	5.00	3.00	.....	1.16	.....	Dry.
269	Santa Rosalia, Mex.....	do.....	.....	.....	.....	4.75	.....	.....	1.14	.....	Dry.
263	Tamaulipas, Mex.....	do.....	.....	.....	.....	.....	.....	.....	1.12	.....	Dry.
374	do.....	do.....	.....	.....	.....	.....	.....	.....	1.10	.....	Dry.
7384	Zahualan, Mex.....	F. Sumichrast.....	.....	.....	.....	5.50	.....	.....	1.37	0.66	Dry.
15	do.....	do.....	.....	.....	.....	6.00	5.00	.....	1.30	0.73	Dry.
8	Tehuantepec, Mex.....	do.....	.....	.....	.....	5.00	4.70	.....	1.25	0.64	Dry.
8300	do.....	do.....	.....	.....	.....	4.40	4.40	.....	1.19	0.54	Dry.
8510	do.....	do.....	.....	.....	.....	5.25	5.25	.....	1.30	0.67	Dry.
8534	do.....	do.....	.....	.....	.....	5.00	3.25	.....	1.10	0.55	Dry.
6995	Tuxpango, Mex.....	do.....	.....	.....	.....	5.30	3.30	.....	1.05	0.60	Dry.
6996	do.....	do.....	.....	.....	.....	4.50	3.00	.....	0.97	0.60	Dry.
7310	Orizaba, Mex.....	do.....	.....	.....	.....	5.00	3.00	.....	0.98	0.58	Dry.
9095	Mirador, Mex.....	C. Sartorius.....	0.68	1.25	1.45	4.75	3.50	0.51	1.05	0.63	Alcoholic.
8392	do.....	do.....	.....	.....	.....	.....	.....	.....	.....	.....	Alcoholic; young.
6300	do.....	do.....	.....	.....	.....	.....	.....	.....	.....	.....	Alcoholic; young.
4804	do.....	do.....	.....	.....	.....	.....	.....	.....	.....	.....	Alcoholic; young.

\* There is some mistake in Professor Baird's measurement of No. 34 (6.00 long; tail, 4.53); the specimen does not show these dimensions.

† Type of *S. "berlandieri"*, Baird.

‡ Representing *Hesperomys (Deltomys) "toltecus"*, De Sansac.

If these specimens are all really of one species (as we hold, and aim to prove), the limits of variation are set somewhat further apart, as would be expected from the extent of country, representing different climatic conditions.

Excluding Nos. 8 and 8820 as obviously overstuffed (they could not have exceeded 6.00 in the flesh), the length of the body remains substantially

the same, and with nearly the same limits of variation that were found in the Carolina series (4.40 to 6.00), though none drop to 4.00. The same may be said of the ears, fore feet, head, nose to ear, and nose to eye. The case is different respecting the tail and hind feet, in which we get some new figures requiring attention, as the dimensions of these parts have entered into the specific diagnoses.

For all the United States specimens, except three (Nos. 8820, 566, and 8), both the absolute and relative length of the tail is almost exactly as in Carolina skins; if anything, the tail is rather shorter than longer. In none of the United States specimens do the feet differ appreciably from the Carolina figures. In No. 8, the tail first touches 4 inches; the tail of 8820 is a little longer (4.30); that of 566 (type of "berlandieri") is still longer (4.60). But not one of these even *equals*, not to mention exceeding, the head and body, as alleged for "berlandieri". In several Mexican skins, similarly, the tail surpasses 4.00 (Nos. 9385, 9508, 9509, 9510); and in two of these (9509, 9510) it actually equals the trunk. These are the only instances of this occurrence in the whole series; and that they fall in the category of individual variations is proven by the following considerations:—First, these specimens are associated with others (Nos. 9534, 6995, 6996, 7210) positively identical in every respect, and in which the tails bear the ordinary positive and relative length of Carolina skins; secondly, the Texan and Mexican skins differ more *inter se* in length of tail than they do from the Carolina ones; thirdly, we can form from our two tables the following graduated series of tails' lengths: 2.25, 2.40, 2.50, 2.70, 2.75, 3.00, 3.10, 3.20, 3.30, 3.40, 3.50, 3.60, 3.70, 3.75, 3.90, 4.00, 4.30, 4.40, 4.60, 4.70, 5.00, 5.25! Where shall we make a break in this chain to establish specific difference upon length of tail? It is hard to admit a variation of two inches in the tail of an animal the tail of which only averages three inches long; but we do not see how to get around the figures.

We found the feet of Carolina specimens to range from 1.00 to 1.30. Among the Southwestern United States and Mexican examples, we have a slight widening of the limits—from 0.97 to 1.37 and 1.40. The foot of 4927 is indeed enormous, 0.10 longer than the maximum Carolina foot, and heavy in proportion; while that of 9384 is hardly less. But No. 9385 (a specimen that might have been twin-brother to 9384, the two are so absolutely alike in other respects) immediately sinks the figure to 1.30, which is at the Carolina extreme; and No. 4927 *bis* (taken along with 4927) has the foot within ordinary

limits. And, on the other hand, Nos. 6996 and 7210 have feet a trifle under an inch, yet are positively identical with No. 9508 for example. And in only fifteen Mexican skins the feet range thus: 0.97, 0.98, 1.05, 1.10, 1.10, 1.12, 1.14, 1.15, 1.18, 1.19, 1.20, 1.25, 1.30, 1.30, 1.37!

Mr. Allen has already (*l. c.* 184) called attention to the fact that Professor Baird's own measurements of *S. "berlandieri"* do not bear out his statement that the tail is "equal to or longer than the trunk." "In the latter [*S. hispidus*], the length of the tail to the length of the trunk is as 69 to 100; in the former (*S. berlandieri*), as 63 to 100!" Moreover, if the statement were correct, it would conflict with Professor Baird's generic characters; for he says (p. 501, B. N. A.) that in *Sigmodon* the tail is "shorter than the trunk."

But color has been adduced also, and we are to inquire about this. No. 563, the type of "berlandieri", certainly does not show us the slightest shade of color different from many Carolina skins; the same is the case with some other examples of "berlandieri". Others, however, as Nos. 9021 and 8820, are appreciably paler than any Carolina ones we have seen; being "grayish yellow brown lined with black", exactly as stated by Professor Baird; and this pallor is even surpassed by Nos. 9384 and 9385. Here the bleached color is striking; indeed, the animals are as whitish as *Arvicola "breweri"* compared with *riparius*; and the tail of one of them (the other's tail is broken off) is longer than usual, though still an inch shorter than the trunk. But these are the specimens with the enormous feet, and so differ from "berlandieri" quite as much as they agree with it; and they are associated with other specimens quite as dark colored as the ordinary Carolina *hispidus*.

Some of Professor Sumichrast's skins are typical of the "*Hesperomys toltecus*" of De Saussure (*l. c.*), upon which this naturalist based his subgenus *Deilemys*. There is no question of the accuracy of this identification; the specimens agree in every particular\* with De Saussure's elaborate and faithful description. When we began to examine the animal, we were inclined to think it different from *S. hispidus*, viewing the remarkably small feet, which appear the smaller when compared with such feet as those of No. 9384 for

\* Save one. De Saussure, in commenting upon the affinities of *Deilemys*, remarks its likeness to *Oryzomys*, but says the skull lacks the supraorbital "crête" ascribed to *Oryzomys* by Baird; whereas we find it present in a skull of *Sigmodon toltecus*, taken from No. 7210. But De Saussure may have misapprehended Baird's remarks, or may have had a skull not quite mature. The raised rim of the orbits is not fairly shown except by perfectly adult animals. Moreover, we find it in many other Mexican species, even in such a delicate one as *Nyctemys sumichrasti*, De Saussure, in which this author likewise says it does not exist.

example. But, in every other respect, it is identical with ordinary Carolina *hispidus*; it will be observed that it is not in the long-tailed set; in color it is fully as dark reddish-brown as average *hispidus*, while the feet are, after all, only at or barely below (0.02 or 0.03) the minimum of those of *hispidus*.

Thus it is impossible for us to regard "berlandieri" or "toltecus" as specifically different from *hispidus*. There may be those, however, who are ready to admit all we claim, and yet may think these extremes of one species worthy of being distinguished by name as varieties. We have no real objection to this course; and, with a reconstruction of the original diagnosis of "berlandieri", we will present for such naturalists the best diagnosis that can be framed, which may pass for what it may be worth to them:—

*S. hispidus hispidus*.—Reddish-brown, lined with black, beneath whitish. Tail rarely equaling body alone. Hind foot not over 1.30 nor under 1.00.

*S. hispidus berlandieri*.—Grayish-brown, lined with black, beneath white. Tail sometimes equaling body and head. Hind foot not over 1.37 nor under 1.10.

*S. hispidus toltecus*.—Reddish-brown, lined with black, beneath whitish. Tail rarely equaling head and body alone. Hind foot not over 1.10 nor under 0.95.

We may observe in passing that the specimens of *Sigmodon* with the tail as long as the head and body bear a remarkable superficial resemblance to *Oryzomys*. But *Sigmodon* may always be known, first, by its hispid pelage; secondly, by its large orbicular ears about equaling in height the distance from nose to eye; thirdly, by the subequality of the 1st and 5th toes—the latter reaching little, if any, beyond the base of the 4th, instead of to its middle joint, as in *Oryzomys*. These distinctions sometimes come into play, for we have Mexican and Jamaican skins of *Oryzomys* identical in color with *Sigmodon*, and really requiring a second glance to tell them apart.

Among our United States skins, some, like No. 20, are unusually rusty-colored all over, and represent *Arvicola ferrugineus*, Harlan.

As Professor Baird has shown, the *Arvicola teziana* of Audubon and Bachman is no doubt a *Sigmodon*. The dimensions assigned render any other interpretation impossible. It is true, we have never seen a *Sigmodon*, or any other American Murine or Arvicoline, spotted and blotched in the way described; but such coloration is contrary to all analogy in this group, and cannot be considered normal.

## GENUS HESPEROMYS, Waterhouse.

× *Mus*, sp., AUCTIONUM.

× *Arvicola*, sp., HARLAN, Am. Monthly Journ. 1832, 446 (*nuttalli*).—AUD. & BACH., Q. N. A. (*sonoriensis*, LeC.; *tesana*, Woodh.; and *oryzivora*, Aud. & Bach. = *Mus palustris*, Harl.).

× *Hypudaeus*, sp., MAXIMILIAN, Reise, &c. II, 1841, 90 (*H. leucogaster*, Max. = *Mus missouriensis*, Aud. & Bach.).

> *Musculus*, RAPINESQUE, Am. Monthly Mag. III, 1813, 446 (type, *M. leucopus*, Raf.).

> *Hesperomys*, WATERHOUSE, Zool. Voy. Beagle, 1830, 75 (established to accommodate the New World mice collectively, and therefore equivalent to the tribe *Sigmodontes* as now understood).

> *Calomys*, AUD. & BACH., Q. N. A. II, 1851, 303 (*auricolus*). (Not of Waterh.)

> *Onychomys*, BAIRD, M. N. A. 1867, 458 (type, *Hypudaeus leucogaster*, Max.).

> *Oryzomys*, BAIRD, op. et loc. cit. (type, *Mus palustris*, Harl.).

> *Vesperimus*, COUES, Proc. Acad. Nat. Sci. Phila. 1874, 178 (type, *H. leucopus*).

In proposing the name *Hesperomys*, Waterhouse's idea, as is evident throughout his article in the Zoology of the Beagle, was simply to separate the New World *Murinae*, collectively, from the typical *Mures* of the Old World, upon the broad character of the tuberculation of the molars, which is biseriatim in the former and triseriatim in the latter. Although treating exclusively of the South American species, he says in one place, "*Mus leucopus*, *Neotoma*, and *Sigmodon* certainly belong to the same group." It is plain, therefore, that his "genus" *Hesperomys* is precisely equivalent to the "tribe," or supergenus, now called *Sigmodontes*.

In a word, "*Hesperomys*" is a tribal name, comprehending in itself the genera and subgenera that here follow: A, in South America, *Calomys* (= *Eligmodontia*, F. Cuv.), *Habrothrix*, *Phyllotis*, *Scapteromys*, *Oryzomys*, *Holochilus*, *Reithrodon*; and, B, in North America, *Vesperimus*, *Onychomys*, *Oryzomys*, *Ochetodon*, *Sigmodon*, *Neotoma*.

Almost from the very first, naturalists perceived the heterogeneous character of this assemblage under the comprehensive term *Hesperomys*, and sought to eliminate proper generic groups. Waterhouse himself made a number of subdivisions, which, with some modification, have been generally accepted. It is a matter of obvious necessity to restrict *Hesperomys*, and so define it that it shall designate a homogeneous group. To do this, we have first to throw out the forms worthy of generic separation, then to mark out the subgeneric divisions of *Hesperomys*, and finally to tie down the name in its strict sense to the species upon which it is based.

From the circumstances under which *Hesperomys* was instituted, and the author's evident intention in founding it, it is difficult to say what should be considered as his type-species; really, he had no type in view. But, in draw-

ing his comparisons between *Mus* and the new group he was about to establish, he happened to select *Mus rattus* and *Mus bimaculatus* for that purpose. We may therefore, with entire propriety, elect *Mus bimaculatus* as technically the type of *Hesperomys*. When, in 1837, Waterhouse established the subgenus *Calomys* upon *C. elegans*, he included in it both *bimaculatus* and *gracilipes*. *Eligmodontia* of F. Cuvier, of the same date, has the same strictly consubgeneric species as its type. It is a question, therefore, whether either *Calomys* or *Eligmodontia* ought not to take precedence over *Hesperomys*; but as the latter name has become firmly established, and as the prior name *Calomys* is by the same author, and at least as early as *Eligmodontia*, there is really no necessity for a change.

Resting, then, upon this application of *Hesperomys*, in its strictest subgeneric sense, to such species as *bimaculatus*, *elegans*, and *gracilipes*, we will inquire how far the name may be extended in its generic application. In his able essay of 1857, Professor Baird points out, in elaborate detail, the characters of the South American species, and, excluding *Reithrodon* and *Holochilus* as worthy of full generic rank, he makes *Hesperomys* to include three subgenera, viz.,—*Calomys*, Waterh.; *Habrothrix* (= *Habrothrix* plus *Phyllotis*, Waterh.); and *Oryzomys* (= *Oryzomys* plus *Scapteromys*, Waterh.). Recurring to the North American forms, he establishes three subdivisions,—*Hesperomys*, *Onychomys*, and *Oryzomys*.\* We are able to confirm the validity of these groups in the most unequivocal manner; the only question being whether the *leucopus* group that Professor Baird left in the subgenus *Hesperomys* is not entitled to subgeneric distinction from the South American *bimaculatus*. Professor Baird himself suggests that this ought to be done; and, so far as we can judge from the descriptions of authors, the suggestion is available.

The Vesper mice of North America, collectively, seem to be differentiated from those of South America by characters only less important than that one which trenchantly divides them both from Old World *Mures*. *Neotoma* of North America has nothing whatever to correspond in South America. The large, leporine, grooved-incisor species of South America are generically different from the little murine species that have been called *Reithrodon* in North America. *Holochilus* has no nearer representative than *Stigmodon*, which is

\* Really four subdivisions, as he distinguishes the naked-footed species (*californicus* and *eremicus*) from the *leucopus* type; but he very properly refrains from naming this section. It does not appear to us to have even subgeneric value, as the barefootedness is merely an accident of the animal's desert habitat.

an entirely different genus. And although other species of the large genus *Hesperomys* may not necessarily be separated generically, yet the subgenera seem entirely different. The form *Oryzomys* appears not to be represented at all in South America; while, likewise, the form *Oxymycterus* of South America has no exact analogue. *Onychomys* and *Habrothrix* would seem to represent each other in their arvicoline form, yet they are abundantly worthy of subgeneric separation. Probably the closest approach to identity of form is found in the North American *leucopus* group (and especially the species *aureolus* or *nuttallii*, where alone we have yellowness underneath) with the *Calomys* group (i. e., *Hesperomys* sensu strictiss.); but even here there is room for the subgeneric separation that we make in the succeeding article.

In our comparative ignorance of the South American forms, we shall not venture upon any diagnosis or description of the full genus *Hesperomys*. Ample details of the North American forms will be found under the respective heads of *Vesperimus*, *Onychomys*, and *Oryzomys*. For similar reasons, we refrain from any but North American citations in the foregoing list of synonyms.

We append a table, which may serve to exhibit the correspondences or other relations of the North American with South American forms.

NORTH AMERICAN.	SOUTH AMERICAN.
a. With grooved upper incisors.	
Genus OCHETODON, Coues. Form murine.	Genus REITHRODON, Waterh. Form leporine.
b. With smooth upper incisors.	
Subgenus VESPERIMUS, Coues. Form murine.	Subgenus CALOMYS, Waterh. Form murine.
Subgenus ONYCHOMYS, Baird. Form arvicoline.	Subgenus HABROTHRIX, Waterh. Form arvicoline.
————— !	Subgenus OXYMYCTERUS, Waterh.
Subgenus ORYZOMYS, Baird. Form rat-like.	————— !
Genus HOLOCHILUS, Brandt. Form rat-like.	Genus SIGMODON, Say. Form arvicoline.
————— !	Genus NEOTOMA, Say. Form rat-like.

#### SUBGENUS VESPERIMUS, Coues.

- = *Musculus*, RAFINESQUE, Am. Monthly Mag. iii, 1818, 446 (*leucopus*).  
 < *Hesperomys*, of North American writers.  
 = *Hesperomys*, BAIRD, M. K. A. 1857, 458 (*leucopus*).  
 > *Calomys*, AUD. & BACH., Q. N. A. ii, 1851, 303 (*aureolus*). Not of Waterhouse.  
 = *Vesperimus*, COUES, Proc. Acad. Nat. Sci. Phila. 1874, 178 (type, *Mus leucopus*, aud.).

We restrict our term *Vesperimus* to *leucopus* and its immediate North American allies. As intimated in the foregoing article, it is exactly equivalent



to *Hesperomys* of Baird, as limited by that author, as above cited. *Calomys*, as used by Audubon and Bachman for their *Mus aureolus*, is not a synonym, subgenerically, of *Calomys*, Waterhouse; *aureolus* being strictly of the same group as *leucopus*, while *Calomys* of Waterhouse refers to the South American *elegans*, *bimaculatus*, &c. The only other name, except *Hesperomys*, that we can find has been applied to the present subgenus, is *Musculus* of Rafinesque. This name, in strict technical conformity with the rules of nomenclature, ought to be adopted; and it is nothing to the point that its proposer did not properly define it, for we know that he used it in connection with *leucopus*. But the name is so inseparably connected with *Mus musculus*, that to use it in a different connection, and one where the tribal distinctions from *Mus* especially require to be signalized, would result in an evil of far more consequence than the breach of a rule of nomenclature. While we regret that we happen to be personally interested in this, one of the rare cases where the law of priority must be set aside, nevertheless we cannot disregard its obvious requirements.

The following paragraph is diagnostic of the subgenus *Vesperimus*:—

CHARS.—Of medium and small size, lithe form, and quick movement. Eyes large, prominent. Snout pointed. Ears large, rounded, thin, finely scant-pilous; antitragus evident but not valvular. Fore feet hardly or not half as long as the soles; palms naked; fore claws not larger than hind claws, that of the obsolete thumb rather a nail; other fore digits slender, 3d and 4th subequal and longest, 2d and 5th successively much shorter. Hind feet long, slender; soles 6-tuberculate, naked, or scant-furred on the posterior third; 2d, 3d, and 4th toes much longest and subequal, 5th shorter, 1st much shorter. Tail terete, slender, closely hairy, subequal to the trunk in length (ranging from as long as body alone to a little longer than head and body together). Pelage soft, close, glossy, with but few longer bristly hairs; feet and under parts white or whitish; body and tail more or less distinctly bicolor. No lanuginous tufts of hair about the ears. Back upper margin of orbit not beaded.

The skull and teeth of all the North American *Hesperomys* are so much alike, while the external form is so different in the three sections of *Vesperimus*, *Onychomys*, and *Oryzomys* (as will be evident upon comparing the diagnoses given beyond of these genera), that we have preferred to define *Vesperimus* chiefly by external characters. The skull of *Onychomys* merely differs from that of *Vesperimus* in being a little larger and heavier, not quite

so constricted across the orbits, and having a rather shorter and more swollen rostral portion; the molars are a little larger, with more open indentations of enamel along the sides. The skull of *Oryzomys* enlarges a little upon that of *Onychomys*, and has the sharp edge of the orbits raised into a slight thin crest; there is also some difference in the palate, as described beyond. But these differences are all so slight, that, were they unaccompanied by striking external characters, they could hardly be considered as of more than specific value. In the following description of the skull of *Vesperimus*, the cranial characters of all North American *Hesperomys* will be essentially reflected.

The skull is thin and papery, showing nothing of the solidity and massiveness and strong ridges of *Arvicolineæ*. The cranial part is broad and depressed; the lengthwise profile of the top is one very gentle curve, both behind and before, from the highest point opposite the orbits. The zygomatic width is almost precisely half the total length; the height of the cranium is three-eighths of the total length; the length of the lower jaw is two-thirds of the total length. The zygomata, very slender and strictly styloid, dip deeply down to the level of the palate. At first, they stand out at right angles with the skull, then sweep abruptly backward till they become parallel, and then turn abruptly up to the squamosal. Nearly all the arch is made by the large processes of the maxillary and squamosal; the jugal itself being extremely minute. The cranial part of the skull does not noticeably encroach upon the orbits, which are rather shallow subcircular cups, with the principal foramina crowded into a depressed corner low down and far back, just above the alveolar level—in fact, a little behind (if anything) the last molar. The interorbital constriction is moderate, but always wider than the rather slender and tapering rostrum. The nasal bones stick far out in front, with the intermaxillaries, surpassing a perpendicular let fall upon the faces of the incisors; behind, these bones are likewise subequal, and they nearly or quite reach to opposite the orbits (they vary a good deal in different species, as well as in different specimens of the same species, in this regard). The foramen magnum is large, subcircular, or trefoil from emargination superiorly. The parietals are small and subquadrate; the interparietal is small and short for its width; the bullæ osseæ are small, very thin, and very obliquely placed, owing to the wedge-shape of the basi-occipital. The incisive foramina are rather open, but short, ending in advance of the molars. The palate ends behind almost exactly as in *Mus*, as far as configuration is concerned; but it does not reach

so far back, terminating nearly or exactly opposite the last molars (see *Oryzomys*). The lower jaw is straighter on the whole than in many Murines, from the great backward set of its condylar ramus; but in spite of this obliquity, the coronoid is so short (a mere little sharp point of bone) that it does not attain the level of the condyle. The outside of the ramus is strongly ridged by the passage of the incisor-root. The descending process of the lower jaw is rather slight, subtriangular, with a sharp termination, lies below the level of the molars, and has its under edge inflected.

Before noticing the dentition, we may pause to observe what indication of the habits and food of the animal the bare skull affords us, without reference to the teeth. The comparative weakness of the whole masseteric arrangement is evident. It is a wide remove from the climax of rodent masticatory apparatus seen in the *Arvicolinae*, where the short solid skull and massive jaws and deep muscular impressions and prominent bony *points d'appui*, are all so conspicuous. There is even less of this sort of thing than is seen in *Mus* or *Neotoma* or *Sigmodon*. The thinness and smoothness of the skull, and the comparatively slight bony points it develops, prepare us for the very modest dental armature that we find, and clearly indicates a diet of much softer substances. The teeth of *Neotoma* or *Sigmodon* or *Mus* are hardly more inferior in power to the ever-growing heavily-mailed grinders of *Arvicolinae* than are the teeth of *Hesperomys* to those of the genera just named. Among American forms, no one except *Ochetodon* has such small and weak molars as *Vesperimus* shows.

The incisors offer nothing specially noteworthy. The upper are short, much curved, narrow across, a good deal deeper than broad, smooth in front, and shortly obliquely beveled behind; the under are much longer and slenderer, and with longer beveling. The molar series is both short and narrow, between one-sixth and one-seventh the length of the skull, and thus hardly longer than the distance between them, or the width of the palate. The molars rapidly decrease in size from before backward, particularly in the upper jaw, where the last one is subcircular, and not more than half as large as the middle one, which itself is less than the front one; in the lower jaw, the same progressive diminution occurs, but the difference in size is not quite so evident. The molars of the upper jaw have three roots apiece, two external and one internal; those of the under jaw have but two, placed one after the other on the median line.

In *Hesperomys*, as in *Mus* and *Ochetodon*, and not as in *Sigmodon* and *Neotoma*, the tubercles of the molar crowns are long persistent. A great majority of the specimens of *Hesperomys* in the collection before us present the tubercles intact, while it is rare to see skulls of *Neotoma* and *Sigmodon* in which the crowns are not already ground flat, so as to show the dentine area surrounded by the plicated enamel-sheet. This would seem to argue a much slower growth of the grinders. In the rapidly and continuously growing molars of *Arvicola*, the crowns are worn flat, and show their characteristic dentine triangles as soon as they fairly surmount the alveoli; here the opposite extreme is witnessed. The unworn molars of *Hesperomys* show a double lengthwise series of conical tubercles connected by lower crosswise ridges, and the whole face of the tooth is encased in a sheet of enamel continuous with that of the sides of the tooth. Although, as we have said, the main tubercles are biserial, yet the first pair of the front molar of either jaw may appear like one, from being so close together; this azygos anterior one being followed by two perfectly distinct pairs; the second tooth has only two pairs, but perfectly distinct ones; on the small hinder tooth, the pairing of the tubercles is obscure. The tubercles are not exactly opposite each other in crosswise pairs, but are half-alternating. Down between the bases of these conical eminences are seen furrows, the more readily noticeable because generally blackened, apparently by the sticking of foreign matter in them. They represent the deep close-curved plications of enamel that penetrate the tooth from either side; the ends of the loops nearly or quite meeting in the substance of the tooth.

If the foregoing account is perfectly intelligible, it will be seen that, after abrasion has commenced, the molar crowns will present a different pattern with each stage of the process. The main conical tubercles are first razed, and then the connecting crests and little accessory tubercles follow by the same filing-down operation; consequently, the pattern of the molar crowns must be used as a zoological character with great caution, if at all; the minor details are of no sort of consequence; and even in using this broad pattern it is necessary to compare age for age (or rather condition for condition, since different individuals get their teeth filed down with variable rapidity) in drawing up the characters of species or subgenera. At the last stage specified, namely, when main tubercles and connecting crests and accessory tubercles have disappeared, we see a single dentine area occupying the whole face of

the tooth, surrounded by a zigzag enamel-wall, which sends into the dentine space, from each side, two indentations; these indentations on the outer side being much deeper than those from the inner side, and semicircular in outline, with convexity forward; these indentations being *loops* of enamel, *i. e.*, consisting of the enamel-sheet folded against itself; at the point of the beginning to fold, there is, of course, an external nick or reëntrance, and so there are two of these on each side of the tooth, the inner being the more open. In the next stage, a little further abrasion grinds out the continuity of these inlying enamel-folds with the general enamel-envelope, because the folds are not so deep down in the substance of the tooth at its edges as they are in the interior; and then we have the condition of crescentic islands of enamel lying in the general dentine area that is surrounded by the general indented enamel-wall. This occurs at full maturity. The final condition of senile decline is still something different; for, lastly, these enamel islands are entirely rubbed out, and the face of the tooth is one continuous area of dentine, a little excavated or sunken below the level of the continuous exterior sheet of enamel that irregularly surrounds it.

These special details, though readily observed, are difficult to describe clearly, and the description must be followed with specimens in hand. The student may imagine the top of a pigeon-pie, full of humps and hollows, gradually razed down by a succession of thin, parallel, horizontal slices. Let the crust be the enamel, and the substance of the pie the dentine; the first slice will shave off the tops of one or more humps, exposing the interior (dentine) in isolated places, these islands lying in a net-work of crust (enamel); other slices will make a continuous hole through the crust (enamel), exposing a continuous area (dentine) bounded by an irregular wall of crust; and so on.

All this is very different from the straight upright bundles of prisms that compose the teeth of *Arvicola*; after the bumpy tops of which are once filed down smooth, further abrasion, continued never so long, does not essentially modify the pattern of the crowns.

#### HESPEROMYS (VESPERIMUS) LEUCOPUS.

##### White-footed or Deer Mouse.

*American Field Mouse, or Rat*, PENNANT, Synopsis, 1771, No. 303; Hist. Quad. 1791, No. 302; Arct. Zool. 1, 1784, 131.

*American Wandering Mouse*, BARTON, Med. & Surg. Journ. Phila. 1, 1805, 31 (notices a great migration by Lake Erie).

- Mus sylvaticus*, var., ERKLEBEN, Syst. An. i, 1775, 390 (based on the New York var. of Pennant).  
*Mus sylvaticus* var. *noveboracensis*, FISCHER, Synops. 1829, 318 (New York variety).  
*Mus noveboracensis*, SELYS-LONGCHAMPS, Études de Microm. 1839, 67.  
*Mus agrarius* var. *americanus*, "KERR's LINNÆUS, 1792, 231" (based on Pennant).  
*Hesperomys* (*Vesperimus*) *americanus*, COUES & YARROW, Rep. Zool. Expl. W. 100th Merid. 1875, — (in press).  
*Mus agrarius*, GODMAN, Am. Nat. Hist. i, 3d ed. 1860, 316 (also in the earlier editions).—LINSLEY, Am. Journ. Sci. xlii, 1842, 351.  
*Musculus leucopus*, RAVINUSQUE, Amer. Monthly Mag. iii, 1813, 446.  
*Mus leucopus*, DESMAREST, Mamm. ii, 1822, 307.—HARLAN, Fn. Amer. 1825, 151.—GRIFFITH, Anim. Kingd. v, 1827, 233.—FISCHER, Synops. 1829, 326.—J. RICHARDSON, Zool. Journ. ii, 1818; Fn. Bor.-Am. i, 1829, 142 (perhaps rather referable to var. *sonoriensis*).—DEKAY, N. Y. Zool. i, 1842, 82, pl. 23, fig. 1.—AUD. & BACH., Q. N. A. i, 1849, 300, pl. 46.—THOMPSON, Nat. Hist. Vermont, 1853, 13.—KENNICOTT, Agric. Rep. U. S. Patent Office for 1855 (1857), 90, pl. 10.  
*Hesperomys leucopus*, LECONTE, Proc. Acad. Nat. Sci. Phila. vi, 1852, 413.—BAIRD, M. N. A. 1857, 459.—ALLEN, Bull. Mus. Comp. Zool. i, 1899, 227 (Massachusetts), and ii, 1870, 178 (Florida).—DALL, Alaska and its Resources, 1870, 577.—MAXIMILIAN, Arch. Naturg. xviii, 1862, pl. 4, f. 4 (penis-bone); Vers. N.-Am. Süg. 1862, 156.—And of most late writers.  
*Hesperomys* (*Vesperimus*) *leucopus*, COUES, Proc. Acad. Nat. Sci. Phila. 1874, 178.  
*Cricetus myoides*, GAPPER, Zool. Journ. v, 1830, 304, pl. 10 (Canada).  
*Hesperomys myoides*, BAIRD, M. N. A. 1857, 472 (Vermont; based on Gapper).  
*Arvicola emmonsi*, DEKAY, Rep. Quad. Mass. 1840, 61.  
*Hesperomys maniculatus*, WAGNER, Wiegmann's Archiv, 1843, ii, 141, and 1845, ii, 148; Abhand. Akad. Wissensch. v, pt. ii, 1848, 316 (Labrador).  
*Hesperomys pollonotus*, WAGNER, Wiegmann's Archiv, 1843, ii, 52 (Georgia).  
*Hesperomys campestris*, LECONTE, Proc. Acad. Nat. Sci. Phila. vi, 1852, 413 (New Jersey; type, No. 4736, Mus. Smith.).—AUD. & BACH., Q. N. A. iii, 1854, 295 (after LeConte).—BAIRD, M. N. A. 1857, 485 (after LeConte).  
*Hesperomys texanus*, WOODHOUSE, Proc. Acad. Nat. Sci. Phila. vi, 1853, 242; Sitgreave's Rep. Expl. Zuni River, 1853, 48, pl. 2 (El Paso, Tex.; type, No. 2559, Mus. Smith.).—AUD. & BACH., Q. N. A. iii, 1854, 319 (after Woodhouse).—BAIRD, M. N. A. 1857, 464, pl. 8, fig. 1, pl. 52, fig. 5, a-b (Texas and New Mexico); U. S. & Mex. Bound. Surv. ii, pt. ii, 1859, 43.—KENNERLY, P. R. R. Rep. x, 1859, 14, pl. 8, fig. 1.  
*Hesperomys cognatus*, LECONTE, Proc. Acad. Nat. Sci. Phila. vii, 1855, 442 (Southern States; types, Nos. 4700, 4709, Mus. Smith.).—BAIRD, M. N. A. 1857, 469 (Southern States).  
*Hesperomys gracilis*, LECONTE, Proc. Acad. Nat. Sci. Phila. vii, 1855, 442 (Ohio or Michigan, and Wisconsin; types, Nos. —, 4710, Mus. Smith.).  
*Hesperomys austerus*, BAIRD, Proc. Acad. Nat. Sci. Phila. vii, 1855, 336 (Washington Territory; types in Mus. Smith.); M. N. A. 1857, 466.—COOPER & SUCKLEY, Nat. Hist. Wash. Terr. 1860, 102, 127.  
*Hesperomys boylii*, BAIRD, Proc. Acad. Nat. Sci. Phila. vii, 1855, 335 (El Dorado County, California; type, No. 356, Mus. Smith.); M. N. A. 1857, 471, pl. 8, f. 3, pl. 52, fig. 3, a-e (California, Oregon, and Washington Territory).  
*Hesperomys gambeli*, BAIRD, M. N. A. 1857, 404 (Pacific coast, United States).—NEWBERRY, P. R. R. Rep. vi, 1857, Zool. 60.—BAIRD, P. R. R. Rep. Cal. Route 1859, No. 3, 82.—COOPER & SUCKLEY, Nat. Hist. Wash. Terr. 1860, 102, 127.  
? *Hesperomys indianus*, MAXIMILIAN, Archiv für Naturg. xviii, pt. i, 1862, 111; Vers. N.-Am. Süg. 1862, 159 (Indiana).

NOTE (1).—References to the recognized varieties of *leucopus* are excluded from the above, and will be found under their respective heads.

NOTE (2).—It is not certain that some other specific name will not be required to be adopted instead of the established *leucopus* which we continue to use. Since the animal falls in a different genus from *Mus*, *sylvaticus* or *agrarius* might perhaps be employed, though both of these terms were originally proposed for another species. Another candidate for recognition is the varietal term *americanus*, said to appear in Kerr's Linnæus, 1792. The latter will be found used by Dr. Yarrow and ourselves in the forthcoming volume above cited; as we fully expected, at the time of allowing it to pass into metal, to be able to verify the quotation. Reference to Kerr's work, however, having proved impracticable, the term *leucopus* is allowed to stand, pending final settlement of the question.

The characters of *Hesperomys leucopus* will have been so fully elucidated by the time we have concluded the investigation that we purpose entering

upon to prove the position we assume regarding certain nominal species, that no detailed description is required in this connection. Some general observations, however, will not be out of place here.

The under parts of the adult animal are snowy white, and this includes the upper surfaces of both fore and hind feet to the wrist and ankle, and usually the greater part of the outside of the fore leg also, so that the sharp line of demarkation between the white and the color of the upper parts generally passes in a pretty straight line by the shoulder along the side of the neck and side of the head, a little below the eye, to the snout. But the extension of color down the fore leg is utterly indefinite, for two reasons:—first, in the young, while still gray, the color normally reaches the paws, and its subsequent restriction is a matter of gradual change with age; yet a great many individuals do not seem to perfect this change, but remain for some seasons at least in the same condition; and, secondly, many young ones have the outside of the legs as largely white as they ever become in the old. As a specific character, therefore, this feature is not of the slightest consequence.

In general, the color of normal adult examples, as No. 1434 from Massachusetts, is a rich fawn, with a pretty well defined dorsal darkening lengthwise from occurrence of black-tipped hairs along the back. But this "typical" coloration is expressed in noticeably few of the specimens that make up an average miscellaneous lot—probably not one in six; while the departures from it defy description.

This is, moreover, independent of the normal regular change of pelage with age. The young are at first plumbeous-gray above and ashy-white below, without a trace of brown or fulvous shade; this has to change gradually into the hue given in the last paragraph. In a considerable proportion of specimens, the change is observed to begin along the sides as an indistinct stripe of fulvous; and this progresses until the whole pelage is changed. This lateral stripe is sometimes pretty sharp, but oftener merges insensibly into the gray color; so that we are unable to lay down any appreciable stages in the transition.

It is also highly probable that a considerable percentage of individuals pass their whole lives in a pelage nearer gray than fawn color; and it is unquestionable that the animal can and does breed in such condition.

In the vast majority of instances, the tail is pretty sharply bicolor—white underneath, and on top corresponding in color to the back. The dark area

occupies from one-third to nearly or quite one-half of the circumference—generally about two-fifths. But, in many cases, the line of separation is obscure, and then the tail is simply paler below than above. Even some otherwise typical Massachusetts specimens show this last condition.

The variation in absolute and relative length of the tail is greater than in any other dimension. It ranges from obviously longer than the head and body to about equal to the body alone. This, it should be observed, is independent of locality, and exclusive of what we have admitted further on as a variety *sonoriensis*. Mr. J. A. Allen, who has paid particular attention to the variability of feral animals, finds that in Massachusetts specimens alone the proportion of tail to trunk may be as 1.18 : 1.00, or as 0.69 : 1.00—a difference of over fifty per cent. of the mean; and that the number of caudal vertebrae themselves ranges from twenty-four to thirty or more. But this ceases to be remarkable when we recollect that it is purely a matter of what has been aptly called "vegetative repetition". It seems to be a well-nigh universal law that those parts or organs that are the least specialized,—i. e., those of which several have the same or corresponding character and function,—are liable to be produced with a high degree of irregularity as regards their number; and the more such there are the wider are the limits of variation apt to be. In this species, one of our longest-tailed rodents, the law is perfectly illustrated.

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Since none of the nominal species that have been erected upon the variations of *leucopus* depend in any way upon cranial characters; and since the valid species of *Vesperimus* likewise offer no noticeable cranial features beyond slight differences in dimensions (greater in *californicus* and less in *michiganensis* for example), the skulls of all our North American *Hesperomys*, except those of the subgenera *Onychomys* and *Oryzomys*, may be most conveniently examined collectively.





TABLE IX.—Measurements of seventy-five skulls of *HESPEROMYS LEUCOPUS*, *sp.*—Continued.

Number.*	Locality.	Length.	Height.†	Zygomatic width.	Interorbital width.	Length of lower jaw.‡	Specimen and remarks.
1222	Monterey, Cal .....	1.00	0.37	0.53	0.17	0.65	Typical of "gambeli".
1223	do .....	1.00	0.37	0.52	0.17	0.65	do.
0000	Fort Tjon, Cal. ....	1.04	0.43	0.54	0.18	.....	Representing "gambeli".
0010	do .....	1.02	.....	.....	0.18	0.65	do.
0020	do .....	1.03	0.42	0.51	0.18	0.64	do.
0011	do .....	0.97	0.37	0.50	0.16	0.61	do.
0000	Simlahmo, Wash .....	1.00	0.37	0.50	0.17	0.64	Supposed "austerus" or "boylii."
1227	Stellacoom, Wash .....	0.95	0.35	0.45	0.15	0.60	Typical of "austerus".
1201	do .....	0.93	0.38	.....	0.16	.....	do.
1202	Charco Escoudido .....	1.00	0.38	0.54	0.17	0.64	Representing "texanus".
1203	Pecos River, N. Mex. ....	0.96	0.38	0.50	0.19	0.62	do.
1222	El Paso, Tex. ....	1.04	0.39	.....	0.18	0.66	do.
0011	Turkey Creek, Tex. ....	1.10	0.40	0.55	0.18	0.68	do.
0020	El Paso, Tex. ....	1.10	0.40	0.54	0.20	0.68	Purporting to be var. <i>sonoriensis</i> .
0014	Fort Whipple, Ariz .....	1.10	0.43	.....	0.20	0.69	Representing <i>sonoriensis</i> .
0010	do .....	0.96	0.40	0.48	0.16	0.59	do.
0010	do .....	0.97	0.42	0.50	0.17	0.58	do.
1224	Santa Cruz, Son. ....	1.02	0.38	.....	0.18	.....	Var. <i>sonoriensis</i> .
1200	Fort Pierre, Dak. ....	1.03	0.38	0.53	0.18	0.63	do.
1200	do .....	1.03	0.35	0.50	0.17	0.60	do.
0000	Little Missouri River .....	1.03	0.38	.....	0.17	0.68	do.
0004	Klamath Lake, Oreg. ....	0.96	0.36	0.50	0.17	0.60	Representing "gambeli".
0000	New Jersey .....	0.94	0.37	.....	.....	.....	Type of "campestris".
0029	Santa Clara, Cal .....	1.11	0.41	0.56	0.20	0.70	Typical of <i>H. californicus</i> .
1204	Saint Louis, Mo. ....	0.90	0.38	0.49	0.16	0.60	Typical of <i>H. michiganensis</i> .
1200	do .....	0.94	0.37	0.48	0.16	0.60	do.
1202	do .....	0.88	0.35	.....	0.15	0.57	do.
1202	Racine, Wis. ....	0.92	0.36	.....	0.15	0.60	do.
1210	Saint Louis, Mo. ....	0.98	0.40	.....	0.17	0.64	Typical of <i>H. aureolus</i> .
0010	Knoxville, Tenn .....	1.09	0.40	0.55	0.19	0.68	do.
001	Kemper County, Miss .....	1.01	0.40	0.52	0.18	0.64	do.
1202	Society Hill, S. C. ....	1.10	0.40	0.57	0.20	0.65	do.
1202	Schnylkill River, Pa. ....	1.05	0.40	0.51	0.18	0.68	<i>H. aureolus</i> ?
000	Carlisle, Pa. ....	1.00	0.39	0.51	0.18	0.64	<i>H. aureolus</i> ?
000	Unknown .....	0.99	0.38	0.50	0.18	.....	

\* In the fractional numbers, the numerator is that of skull itself, the denominator being that of the corresponding skin.  
† The "height" is taken by laying the skull on a glass plate (when it rests upon the incisors and bullae osseae), and measuring from the glass to the highest point, which is at the parietals, in a perpendicular that passes slightly in front of the bullae.  
‡ From tip of incisors to back of condyle.

All the skulls of obviously ungrown animals are excluded from the foregoing table as tending to vitiate general results, although there are many included of specimens in the gray state of pelage.

On examining the table, it will be seen that the chief discrepancy the series affords is in the case of *H. michiganensis*. This averages noticeably less than

the average of the rest, and about equals, or rather falls a little short of, the minimum of *leucopus*. In length, no full-grown skull of *leucopus* drops to 0.90, while the average of *michiganensis* is only 0.94; and the average length of the under jaw of *michiganensis* is similarly just under the minimum of *leucopus* (0.60). It is probable that *californicus* would just overreach, on an average, the maximum of *leucopus*; but, with only one specimen before us, we cannot declare this to be so. All the other skulls in the lot fall entirely within the usual limits of variation of *leucopus* proper. Here the range is from 0.94 to 1.10, as minimum and maximum, with an average of barely over 1.00. The zygomatic width of the skulls is just about half their length; it ranges from 0.45 to 0.57. The height of the skulls, measured as already explained, is about 0.37; the length of the lower jaw is about 0.62; the interorbital width runs a trifle under 0.20.

We open the discussion with the examination of a series of eighty-two specimens, collected at all seasons in the same locality. This will certainly give us the individual variability of the species,—its normal flexibility, independent of those topographic or climatic influences which tend, when operative, to bend it into geographical differentiation. The measurements are reliable, at least half of them being taken from alcoholic specimens; while the dried skins were prepared with especial care by Mr. Jenks. Nevertheless, we shall make liberal allowance (see below) for taxidermal defects and other sources of error in calculating our limits of natural variation, as well as in deducing the normal standard of size and proportion of parts.

TABLE X.—Measurements of eighty specimens of *HESTEROMYS LEUCOPUS*, from Middleborough, Mass., collected by J. W. P. Jenks.

Number.	Sex.	Date.	Nose to—				Tail to end of—		Fore foot.	Hind foot.	Ear.	Nature of specimen.
			Eye.	Ear.	Occiput.	Tail.	Vertebrae.	Hairs.				
		1855.										
2713	....	Aug. or Sept. . . . .	0.55	0.95	1.16	3.55	2.83	.....	0.36	0.80	.....	Alcoholic.
2714	....	....do . . . . .	0.50	0.92	1.14	3.41	.....	.....	0.35	0.83	.....	Alcoholic.
2715	....	....do . . . . .	0.50	0.90	1.14	3.13	3.25	.....	0.36	0.80	.....	Alcoholic.
2716	....	....do . . . . .	0.50	0.90	1.14	3.30	3.00	.....	0.38	0.80	.....	Alcoholic.
2717	....	....do . . . . .	0.50	0.91	1.14	3.35	3.15	.....	0.35	0.81	.....	Alcoholic.
2720	....	....do . . . . .	0.50	0.90	1.14	3.30	3.10	.....	0.34	0.80	.....	Alcoholic.
2721	....	....do . . . . .	0.52	0.94	1.19	3.45	3.10	.....	0.40	0.83	.....	Alcoholic.
2722	....	....do . . . . .	0.51	0.93	1.15	3.30	3.16	.....	0.36	0.80	.....	Alcoholic.

TABLE X.—Measurements of eighty specimens of *HESPEROMYS LEUCOPUS*—Continued.

Number.	Sex.	Date.	Nose to—				Tail to end of—		Fore foot.	Hind foot.	Ear.	Nature of specimen.
			Eye.	Ear.	Ocul-pus.	Tail.	Ver-tebrae.	Hairs.				
		1855.										
2723	....	Aug. or Sept...	0.49	0.80	1.12	3.00	3.00	.....	0.36	0.78	.....	Alcoholic.
2724	....	do .....	0.49	0.88	1.11	2.96	2.75	.....	0.36	0.79	.....	Alcoholic.
2725	....	do .....	0.50	0.95	1.10	3.15	3.12	.....	0.38	0.80	.....	Alcoholic.
2726	....	do .....	0.52	0.94	1.15	3.50	3.21	.....	0.40	0.78	.....	Alcoholic.
2727	....	do .....	0.54	1.02	1.19	3.45	3.38	.....	0.45	.....	.....	Alcoholic.
2727	....	do .....	0.52	0.90	1.17	3.40	3.30	3.53	0.34	0.82	0.60	Alcoholic.
2728	....	do .....	0.52	0.98	1.25	3.45	3.30	3.50	0.34	0.83	0.61	Alcoholic.
2729	....	do .....	0.51	0.90	1.16	3.42	3.26	3.41	0.33	0.81	0.57	Alcoholic.
2730	....	do .....	0.52	0.95	1.16	3.25	3.25	.....	0.34	0.81	.....	Alcoholic.
2731	....	do .....	0.51	0.90	1.16	3.39	3.50	3.70	0.33	0.80	0.55	Alcoholic.
2732	....	do .....	0.52	0.95	1.16	3.38	3.05	.....	0.38	0.81	0.57	Alcoholic.
2733	♂	do .....	0.50	0.90	1.20	3.55	3.10	3.26	0.39	0.81	.....	Alcoholic.
2734	♂	do .....	0.51	0.90	1.15	3.09	3.34	.....	0.33	0.85	0.55	Alcoholic.
2735	....	do .....	0.50	0.87	1.10	2.95	2.70	.....	0.31	0.78	0.50	Alcoholic.
2736	♂	do .....	0.49	0.83	1.05	3.05	2.61	.....	0.32	0.77	0.50	Alcoholic.
2738	♂	do .....	0.50	0.80	1.10	3.25	2.90	.....	0.31	0.78	.....	Alcoholic.
2739	....	do .....	0.50	0.90	1.14	3.01	2.90	.....	0.31	0.77	.....	Alcoholic.
2790	♂	do .....	0.48	0.80	1.02	2.92	.....	.....	0.30	0.77	.....	Alcoholic.
747	....	June 6 .....	.....	.....	.....	4.00	3.80	3.90	.....	0.78	.....	Dry.
748	0	May 31 .....	.....	.....	.....	2.75	2.60	.....	.....	0.75	.....	Dry.
749	....	do .....	.....	.....	.....	3.20	3.00	.....	.....	0.80	.....	Dry.
750	....	June 12 .....	.....	.....	.....	3.20	2.60	.....	.....	0.70	.....	Dry.
753	♀	April .....	.....	.....	1.17	3.66	3.08	3.17	0.36	0.77	.....	Alcoholic.
753A	♂	May .....	.....	.....	1.17	3.25	3.17	3.30	.....	.....	.....	Alcoholic.
871	♀	April .....	.....	.....	.....	3.00	2.80	.....	.....	0.81	.....	Dry.
872	♂	do .....	.....	.....	.....	3.10	3.20	.....	.....	0.80	.....	Dry.
873	♂	May and June.	.....	.....	.....	3.00	2.80	.....	.....	0.82	.....	Dry.
874	♀	do .....	.....	.....	.....	2.80	2.90	.....	.....	0.79	.....	Dry.
875	♂	do .....	.....	.....	.....	2.90	2.50	2.60	0.35	0.75	.....	Dry.
876	♀	do .....	.....	.....	.....	3.10	2.90	3.00	0.38	0.81	.....	Dry.
877	♂	do .....	.....	.....	.....	2.75	2.60	.....	.....	0.80	.....	Dry.
878	♂	do .....	.....	.....	.....	2.50	.....	2.50	0.35	0.75	.....	Dry.
891	♀	Aug. and Sept.	.....	.....	1.08	2.75	3.25	.....	.....	.....	.....	Alcoholic.
892	....	do .....	.....	.....	1.17	3.50	2.75	2.90	0.36	0.90	.....	Alcoholic.
893	....	do .....	.....	.....	1.17	3.17	2.17	2.33	0.37	0.76	.....	Alcoholic.
894	♀	do .....	.....	.....	1.17	2.95	2.42	2.50	0.37	0.70	.....	Alcoholic.
895	♂	do .....	.....	.....	1.15	3.50	3.33	3.60	0.40	0.83	.....	Alcoholic.
896	♂	do .....	.....	.....	1.08	3.00	2.50	2.60	0.36	0.78	.....	Alcoholic.
897	....	do .....	.....	.....	1.08	3.25	2.50	2.66	0.35	0.76	.....	Alcoholic.
899	....	do .....	.....	.....	1.18	3.66	3.33	3.50	0.34	0.75	.....	Dry.
900	0	do .....	.....	.....	1.00	2.33	2.50	.....	.....	.....	.....	Alcoholic.
926	....	do .....	.....	.....	0.90	2.50	2.60	.....	.....	.....	.....	Alcoholic.

TABLE X.—Measurements of eighty specimens of *Hesperomys leucopus*—Continued.

No. spec.	Sex.	Date.	Nose to—				Tail to end of—		Fore foot.	Hind foot.	Ear.	Nature of specimen.
			Eye.	Ear.	Occiput.	Tail.	Vertebrae.	Hairs.				
		1855.										
927	♂	Aug. and Sept.			1.17	3.75	3.35	3.50				Alcoholic.
7429		do										Alcoholic.
7436		do										Alcoholic.
801		June 30	0.55	1.00					0.37	0.80	0.53	Dry.
802		June 20				3.50	3.25		0.36	0.80	0.54	Dry.
803		do	0.45	0.89		3.33	2.90	3.00	0.34	0.78		Dry.
804		June	0.50	0.98		4.00			0.38	0.80	0.63	Dry.
827	♂	September.			1.16	3.75	3.33	3.50				Alcoholic.
935	♂	October 1	0.50	0.96	1.15	3.40	3.40	3.50	0.33	0.80	0.59	Dry.
936		October 30	0.51	1.00	1.18	3.75	3.10	3.55	0.35	0.79	0.58	Dry.
937		October 29	0.48	0.95	1.14	3.50	2.60	2.70	0.34	0.78	0.54	Dry.
939		do	0.46	0.93	1.15	3.30	2.40	2.50	0.33	0.75	0.52	Dry.
940		November 1	0.52	0.99	1.17	3.75	2.60	2.75	0.36	0.81	0.65	Dry.
942	♂	November 3				2.80	2.40	2.50		0.73		Young; dry.
943		October 19	0.48	0.88	1.15	3.40	2.90	3.00	0.35	0.76	0.54	Dry.
944		October 25				2.75	2.40			0.75		Young; dry.
1105		November				3.40				0.83		Dry.
1106	♀	November 15				3.75	2.85	2.95	0.38	0.82	0.58	Dry.
1107	♂	November 13				3.75	3.25	3.35		0.82	0.56	Dry.
1108	♂	November 12				3.60	2.40	2.45		0.78		Dry.
1110	♂	November 16				3.90	2.70	2.80		0.81	0.55	Dry.
1111	♂	November 8				3.40	3.00	3.05	0.32	0.74		Dry.
1112	♂	November 9					2.90	3.00		0.80		Dry.
1113	♂	November 12				3.90				0.78	0.58	Dry.
1114	♂	December 10				3.10	2.55	2.65		0.76		Dry.
1115	♂	November 10				4.00	3.25		0.35	0.83	0.55	Dry.
1116	♂	November 21				3.00	2.65	2.80		0.79		Dry.
1117	♀	November 7				3.50	3.10	3.15		0.72		Dry.
1118	♂	November 20					2.10	2.15		0.73		Dry.
1119	♂	November 10				3.40	2.65	2.70		0.79		Dry.
1120	♂	November 9				3.75				0.80		Dry.
1122		do	0.50	1.00		3.60	2.60			0.81	0.52	Dry.
		1856.										
1433		March 28			1.17	3.33	2.75					Fresh.
1434		March 29			1.17	3.50	3.25					Fresh.
2791												
to												Alcoholic.
2799												
1082												
to												Alcoholic.
1083												
		(Average)	0.51	0.91	1.14	2.26	3.00	3.20	0.34	0.80	0.55	

The average length of the trunk (head and body) of this series is a little over three and a quarter inches.

The average length of the tail-vertebræ is almost exactly three inches. As the usual length of the terminal pencil of hairs is about two-tenths of an inch, the tail may be considered as averaging a little less than the length of the trunk.

The distance from nose to eye averages barely over half an inch; that from nose to ear, barely over nine-tenths of an inch; the length of the head, about one inch and an eighth.

The palms, with the nails, are barely over one-third of an inch.

The soles, with the nails, are almost exactly four-fifths of an inch.

The ears average half an inch and half a tenth of an inch in height, measured from the notch in front.

With these standard dimensions, we have the following range of variation :—

Of the ears, 0.50 to 0.65—a difference of 0.15. But these wide extremes are not often exhibited; the ordinary variation is within 0.10, or about twenty per cent. of the mean.

The soles run from 0.70 to 0.83—a difference of 0.13, and ordinarily range from 0.75 to 0.80. They do not appear to vary quite as much as some other parts; but this may be partly due to the fact that their admeasurement is made with great accuracy, and that they do not change much in drying.

The palms range from 0.30 to 0.40—a difference of 0.10, or nearly thirty-three per cent. of the mean. But this is a difficult measurement to make with nicety, and probably the real variation is not quite so great.

The distance from nose to eye ranges (among the alcoholics, alone reliable in this instance) from 0.49 to 0.59—a difference of 0.10, or twenty per cent. of the mean, as before. The distances from nose to ear, 0.80 to 1.02, and from nose to occiput, 1.02 to 1.25, appear slightly more variable.

But the most important point is the determination of the total length of trunk and of tail, and of their relations to each other; for several supposed species are implicated in this matter. As the figures stand, the shortest specimen has the trunk 2.33 inches, and two others 2.50; but these are not full grown, and it will be well to fix the minimum adult length at not less than 2.75. The maximum length as given is 4.00, but the two or three specimens which alone touch this figure are certainly overstuffed,\* and it will be safe to fix

\* We have seen specimens stuffed up to 4.50 without obvious distortion.

the maximum at 3.75. Even with this liberal cutting-off of extremes, we find *Hesperomys leucopus* to range from 2.75 to 3.75 in the same locality, and establish a variability of a full inch—that is, over twenty-five per cent. of the mean length.

In length of tail-vertebræ, one specimen stands 2.10; but this may be excluded, and 2.40, of which there are several instances, be accepted as a normal adult minimum. The figure 3.40 is probably the normal adult maximum. When we take in the pencil of hairs at the tip, we should widen the limits a trifle, since this last is a very variable feature. The whole tail, therefore, varies in length at least one inch, and probably a little more, just as we should have anticipated from the nature of the case. We have already seen that the tail averages 0.25 of an inch shorter than the head and body—that is, it just reaches to half-way between the eyes and the snout, the latter distance being 0.50. Now, for its variation of *relative leu<sub>b</sub>.h*, we have:—In several specimens, the tail is a full inch (even after striking off a margin for possible error) shorter than the head and body; in others, the tail is equal to or longer than the head and body—sometimes over a fourth of an inch longer. So that, as the head of this species averages a little over an inch in length, it follows that the tail of *leucopus* may barely exceed the body alone, or it may considerably exceed the head and body together.

It gives us pleasure to find that our results agree very closely with those Mr. Allen reached in his valuable paper\* on the Mammals of Massachusetts. The slight difference comes from the fact that to keep largely within bounds, and so to be unquestionably on the safe side, we lopped off a certain margin from our extremes, while Mr. Allen presented his. His paragraph is well worth quoting in this connection:—

“The most variable character consists in the relative length and number of the caudal vertebræ. About one-fifth of the Massachusetts specimens have the tail-vertebræ equal to or longer than the head and body together; occasionally, a specimen is found in which the tail-vertebræ alone exceed this length by one-fourth to one-half an inch. At least four-fifths, however, have the tail shorter than the head and body, and occasionally one occurs with the tail only equal to the body alone. In these latter, the proportional length of the tail-vertebræ to the length of the head and body is as 68 to 100; in the other extreme, or in those with long tails, as 118 to 100. The variation

\* Bull. Mus. Comp. Zool. 1, 927.

between these extremes is hence about fifty per cent. of the mean—a striking example of the unreliability of this character as a specific distinction. . . . . The number of the vertebrae varies from twenty-four or twenty-five to above thirty. In regard to absolute size, the length of the head and body together in Massachusetts specimens rarely exceeds four inches; the average is between three and a quarter and three and a half; perhaps nearer the latter."

In continuation of this matter, we next bring in our entire series of *Hesperomys leucopus* from Eastern North America, embracing specimens from Labrador to the Carolinas, and westward to Kansas, inclusive (our Arctic and western examples are elsewhere tabulated and discussed). We admit to this series only what we claim as *unquestionable leucopus proper*, excluding even the recognizable geographical races. And even after this exclusion, there are *six* nominal species from the region just indicated requiring our attention.

TABLE XI.—Measurements of about one hundred (and list of many more) specimens of *HESPEROMYS LEUCOPUS* from Eastern North America.

[N. B.—All measured dry unless otherwise stated.]

Number.	Sex.	Locality.	Collector.	Nose to—				Tail to end of—		Fore foot.	Hind foot.	Ear.	Remarks.
				Eye.	Ear.	Head.	Tail.	Vert.	Flare.				
3994	...	Labrador.....	H. De Sausseure..	0.56	1.01	...	3.00	2.90	0.34	0.76	0.56		"artiens", Sausse.
3995	...	do .....	do .....	0.46	0.95	...	2.90	2.40	0.35	0.74	0.55		"bairdii", Sausse.
1479	...	Halifax, N. S. ....	J. B. Gilpin.....	...	...	...	3.00	2.50	0.75	...	0.60		
1473	...	do .....	do .....	...	...	...	3.90	2.70	1.00	...	0.60		
9058	...	do .....	do .....	...	...	...	2.60	2.75	...	0.80	...		
9059	...	do .....	do .....	...	...	...	2.85	1.00	...	0.81	...		
9060	...	do .....	do .....	...	...	...	3.35	1.40	...	0.81	...		
9061	...	do .....	do .....	...	...	...	3.10	1.30	...	0.80	...		
1537	...	do .....	J. Downes .....	...	...	...	3.25	1.45	...	0.75	...		
1358	...	do .....	do .....	...	...	...	...	...	...	...	...		
3910	...	do .....	J. E. Willis.....	...	...	...	3.00	2.90	1.10	0.85	0.60		
983	...	Montreal, Canada ..	do .....	0.60	...	1.90	4.90	3.70	4.10	0.85	0.67		Supposed "myoides", but typical <i>leucopus</i> .
833	...	Belfast, Me.....	G. E. Brackett ..	...	...	...	3.00	...	...	0.80	0.50		Typical <i>leucopus</i> .
833	...	Burlington, Vt.....	Z. Thompson ..	...	...	...	3.00	3.90	3.95	0.75	...		Supposed <i>myoides</i> , but typical <i>leucopus</i> .
839	...	do .....	do .....	...	...	...	3.40	3.05	1.15	0.80	0.65		Typical <i>leucopus</i> .
834	...	do .....	do .....	...	...	...	2.75	2.60	1.70	0.68	...		do.
1319	♀	do .....	do .....	...	...	...	1.17	3.00	3.00	...	...		Type of "myoides".
1313	♂	do .....	do .....	...	...	...	1.17	3.50	3.90	4.25	...		do.
10494	...	do .....	do .....	...	...	...	...	...	...	...	...		Alcoholic; young.
10499	...	do .....	do .....	...	...	...	...	...	...	...	...		Measured in alcohol; typical of "myoides".
9749	...	do .....	do .....	...	...	...	...	...	...	...	...		do.
9743	...	do .....	do .....	...	...	...	...	...	...	...	...		do.
744	♂	do .....	do .....	0.50	0.87	1.11	2.95	3.03	2.95	0.35	0.70	0.64	do.



TABLE XI.—Measurements of about one hundred (and list of many more) specimens of *HESPEROMYS LEUCOPUS* from Eastern North America—Continued.

Number.	Sex.	Locality.	Collector.	Nose to—			Tail to end of—			Fore foot.	Hind foot.	Ear.	Remarks.
				Eye.	Ear.	Head.	Tail.	Vert.	Ilia.				
2745	♂	Burlington, Vt. . . . .	Z. Thompson . . . . .	0.51	0.8	1.16	2.04	1.15	3.31	0.34	0.75	0.64	Measured in alcohol; typical of "myoides".
2746	♂	do . . . . .	do . . . . .	0.47	0.85	1.06	2.70	2.75	2.85	0.36	0.83	0.64	do.
2770	♂	Waterville, N. Y. . . . .	H. Davis . . . . .	0.50	0.81	1.09	2.96	3.15	3.42	0.37	0.78	0.64	do.
4446	♀	Williamst'n, Mass. . . . .	S. H. Scudder . . . . .	0.55	0.98	1.15	3.75	3.25	3.45	0.36	0.75	0.61	Alcoholic.
7176	♂	do . . . . .	do . . . . .	0.55	0.97	1.18	3.75	3.25	3.45	0.40	0.80	0.66	do.
2743	♀	Hingham, Mass. . . . .	T. M. Brewer . . . . .	0.53	0.90	1.15	3.65	3.35	3.53	0.40	0.82	0.65	do.
7039	♀	Naushon . . . . .	S. F. Baird . . . . .	...	...	...	3.30	3.00	3.15	...	...	0.78	do.
2924	♂	Wethersfield, Conn. . . . .	C. Wright . . . . .	...	...	...	...	...	...	...	...	...	Alcoholic.
2732	♂	Nichols, N. Y. . . . .	R. Howell . . . . .	0.51	0.85	1.11	3.50	3.08	...	0.36	0.82	0.61	do.
2733	♂	do . . . . .	do . . . . .	0.54	0.98	1.22	3.55	3.20	...	0.38	0.82	0.65	do.
2734	♂	do . . . . .	do . . . . .	0.50	0.89	1.18	3.25	3.04	...	0.35	0.78	0.60	do.
2735	♂	do . . . . .	do . . . . .	0.46	0.85	1.08	2.97	2.46	...	0.33	0.77	0.54	do.
2740	♂	Tioga County, N. Y. . . . .	do . . . . .	0.48	0.90	1.15	3.03	2.90	...	0.35	0.80	0.55	do.
2741	♂	Sag Harbor, L. I. . . . .	E. N. Byram . . . . .	0.65	0.99	1.20	3.63	2.90	...	0.39	0.85	0.59	do.
2742	♂	do . . . . .	do . . . . .	0.46	0.87	1.05	2.70	2.24	...	0.32	0.75	0.52	do.
2738	♂	Philadelphia, Pa. . . . .	W. S. Wood . . . . .	0.54	0.94	1.18	3.43	2.85	...	0.38	0.80	0.65	do.
2739	♂	do . . . . .	do . . . . .	0.51	0.93	1.16	3.40	2.67	...	0.35	0.75	0.60	do.
2736	♂	Mount Joy, Pa. . . . .	J. Stauffer . . . . .	0.51	0.94	1.18	3.25	2.91	...	0.35	0.78	0.61	do.
2737	♂	do . . . . .	do . . . . .	0.41	0.87	1.10	2.94	2.61	...	0.35	0.75	0.57	do.
4698	♂	Meadville, Pa. . . . .	J. F. Thickston . . . . .	...	...	...	1.15	1.05	2.8	2.03	...	...	do.
508	♂	Carlisle, Pa. . . . .	S. F. Baird . . . . .	...	...	...	...	...	...	...	...	...	do.
63	♂	do . . . . .	do . . . . .	...	...	...	1.10	2.70	...	...	...	...	do.
53	♂	do . . . . .	do . . . . .	...	...	...	...	...	...	...	...	...	Young.
63	♂	do . . . . .	do . . . . .	...	...	...	...	...	...	...	...	...	do.
5136	♀	do . . . . .	do . . . . .	...	...	...	3.25	2.90	1.00	...	0.8	0.63	do.
5155	♂	Pennsylvania . . . . .	S. W. Woodhouse . . . . .	0.46	...	...	3.49	2.00	2.70	...	0.60	0.57	do.
1370	♂	New Jersey . . . . .	W. Cooper . . . . .	...	...	...	3.00	2.40	...	...	0.75	...	do.
1369	♂	New Jersey f. . . . .	do . . . . .	...	...	...	3.20	...	...	...	0.89	...	do.
4730	♂	New Jersey . . . . .	J. LeConte . . . . .	...	...	...	...	...	...	...	...	...	Young; type of "campestris"
1319	♂	Clarke County, Va. . . . .	C. B. H. Kennerly . . . . .	...	...	...	2.75	3.00	...	...	0.61	0.45	do.
1320	♂	do . . . . .	do . . . . .	...	...	...	3.25	3.10	...	...	0.74	0.55	do.
1291	♂	do . . . . .	do . . . . .	...	...	...	3.50	3.20	...	...	0.61	0.52	do.
1292	♂	do . . . . .	do . . . . .	...	...	...	2.60	3.30	...	...	0.75	0.56	do.
1295	♀	do . . . . .	do . . . . .	...	...	...	...	...	...	...	...	...	do.
1297	♀	do . . . . .	do . . . . .	...	...	...	3.50	2.60	...	...	0.78	0.56	do.
1291	♂	do . . . . .	do . . . . .	...	...	...	...	...	...	...	...	...	do.
1297	♀	do . . . . .	do . . . . .	...	...	...	3.50	2.40	...	...	0.72	0.55	do.
1296	♀	do . . . . .	do . . . . .	...	...	...	...	...	...	...	0.73	...	do.
1299	♂	do . . . . .	do . . . . .	...	...	...	...	...	...	...	0.70	...	do.
10512	♂	do . . . . .	do . . . . .	...	...	...	...	...	...	...	...	...	Alcoholic.
10512	♂	do . . . . .	do . . . . .	...	...	...	...	...	...	...	...	...	do.
2773	♂	do . . . . .	do . . . . .	0.5	0.94	1.1	3.00	2.50	1.75	0.31	0.71	...	do.
2774	♂	do . . . . .	do . . . . .	0.55	0.98	1.28	3.32	2.94	1.66	0.38	0.82	...	do.
2775	♂	do . . . . .	do . . . . .	0.58	0.89	1.15	3.09	2.05	...	0.35	0.80	...	do.
7467	♂	Southern States f. . . . .	...	...	...	...	...	...	...	0.74	...	...	Alcoholic; supposed "cognatus".
2810	♂	Tarboro, N. C. . . . .	J. L. Bridger . . . . .	0.49	0.73	1.15	4.94	2.05	2.10	0.32	0.72	0.48	do.
10188	♂	do . . . . .	do . . . . .	...	...	...	...	...	...	...	...	...	do.
673	♂	Hillsboro, N. C. . . . .	M. A. Curtis . . . . .	...	...	...	3.06	2.35	...	0.35	0.75	1.45	Dry; supposed "cognatus".
905	♂	do . . . . .	do . . . . .	...	...	...	3.30	2.50	2.55	...	0.8	1.50	do.
4816	♂	Columbus, Ga.* . . . .	W. Geener . . . . .	...	...	...	3.90	2.35	...	...	0.85	...	Alcoholic.
10087	♂	do . . . . .	do . . . . .	...	...	...	3.40	2.60	...	...	0.87	...	do.

\* These Georgia specimens tend toward, perhaps they are, var. *gossypinus*; but I cannot distinguish them satisfactorily from ordinary *leucopus*.

TABLE XI.—Measurements of about one hundred (and list of many more) specimens of *HESPEROMYS LEUCOPUS* from Eastern North America—Continued.

Number.	Sex.	Locality.	Collector.	Nose to—			Tail to end of—		Fore foot.	Hind foot.	Ear.	Remarks.	
				Eye.	Ear.	Head.	Tail.	Vert.					
10098		Columbus, Ga.	W. Gesner				3.00	2.50		0.78		Alcoholic.	
10099		do	do				3.50	1.00		0.82		do.	
10090		do	do				3.46	1.55		0.82		do.	
4916		New Orleans, La.	J. Varden	0.50	0.00	1.10	3.00	2.75	2.83	0.39	0.78	0.50	Alcoholic; supposed "cognatus".
7407		Prairie Mer Rouge, La.	Jamen Fairie				2.75	2.25		0.75		Alcoholic.	
10034	♂	Grand Coteau, La.	St. Charles College.	0.46	0.06	1.18	3.25	2.75		0.41	0.77	0.57	do.
10085	♀	do	do	0.52	1.00	1.50	3.10	2.70		0.37	0.89	0.55	do.
508		Oxford, Miss.	B. C. L. Wallace				0.93	2.32	1.42		0.71		Alcoholic; supposed "cognatus".
19857		Louisiana	J. Fairie										Six young in alcohol; supposed "cognatus".
583		Washington, Miss.	do				1.17	3.50	0.50	2.60		0.85	Alcoholic; supposed "cognatus".
586		do	do				1.15	1.41	2.75	2.85		0.87	do.
831		Cleveland, Ohio	J. P. Kirtland				3.33	2.50				0.75	do.
5749		Salem, Ohio	E. Newton	0.53	0.09	1.11	1.01	4.02		0.32	0.78	0.63	Alcoholic.
3750		do	do	0.52	0.05	1.12	3.52	3.30		0.40	0.83		do.
3751		do	do	0.52	0.05	1.12	3.30	3.10		0.38	0.85		do.
10440		do	do										do.
10453		do	do										do.
		Illinois	R. Ridgway					4.63			2.78		do.
47442		New Lebanon, Ind.	S. B. Davis										Alcoholic.
590		West Northfield	R. Kennicott										Young.
676		do	do				2.90	2.40		0.82			do.
704	♂	do	do										Young.
732		do	do				2.90	2.31		0.80	0.54		do.
733		do	do										Young.
734		do	do				3.00	2.55		0.80	0.52		do.
735		do	do				3.25	3.00		0.80	0.60		do.
736		do	do										Young.
3731		do	do	0.55	0.06	1.33	3.32	1.07		0.37	0.86		Alcoholic.
3747		do	do	0.52	0.02	1.13	3.35	3.38		0.37	0.89		do.
3748		do	do	0.57	1.00	1.15		4.70		0.34	0.89	0.60	do.
73734		do	do								0.75		do.
3735		do	do								0.76		do.
3752		Racine, Wis.	A. C. Barry	0.51	1.01	1.10	3.06	2.40		0.36	0.77	0.48	do.
3753		do	do	0.43	0.88	1.00	3.03	2.46		0.37	0.78	0.50	do.
10456		do	do										do.
991		do	P. R. Hoy										Young.
4710		Wisconsin	J. LeComte										Young; "gracille".
10892		Wisconsin? Michigan? Ohio?	do					3.80	3.70		0.85		Type of "gracilla".
9853		Indian River, Fla.	G. Würdemann										Alcoholic.
9590		Pembina, Minn.	C. Cavillee	0.50	0.00	1.10	3.00	2.90		0.38	0.71		do.
547		Fort Ripley, Minn.	J. F. Head				3.40	2.70		0.80			do.
510		Saint Louis, Mo.	G. Engelmann										do.
2123	♀	Independence, Mo.	J. G. Cooper				3.50	3.00		0.80			do.
3198	♀	do	do				3.40			0.80			do.
3677		Fort Riley, Kans.	E. Brandt				3.70	4.00		0.85			do.
3678		do	do				4.0	2.90		0.88			do.
4803		do	do				3.40	2.40		0.78			do.

Number.	Sex.	Locality.	Collector.	None to—			Tail to end of—		Hind foot.	Ear.	Remarks.	
				Eye.	Ear.	Head.	Tail.	Vert.				Feet foot.
4011	♂	Fort Riley, Kans.	K. Brandt	..	..	..	3.50	2.50	..	0.82		
4014	♂	do	do	..	..	..	3.00	2.00	..	0.70		
5192	♂	Neosho, Kans.	B. F. Goss	..	..	..	3.75	3.50	..	1.86	Fresh.	
4217	♂	do	do	..	..	..	3.75	3.50	..	0.86	do.	
4521	♂	do	do	..	..	..	3.90	2.87	1.00	0.83	do.	
4525	♂	do	do	..	..	..	3.90	2.50	2.70	0.85	do.	
8941	♂	Kanana.	A. Crocker	..	..	..	..	..	..	..	Young.	
8940	♂	do	do	..	..	..	..	..	..	..		
4073	♀	"Nebraska"	J. O. Cooper	0.36	1.00	1.20	3.50	2.00	1.00	0.39	0.69	Alcoholic.
10118	..	do	do	0.45	0.90	1.05	3.00	0.65	2.72	0.38	0.78	do.
10058	..	Texas	J. H. Clarke	0.55	0.95	1.15	3.75	1.00	3.10	0.36	0.80	do.
10059	..	do	do	0.56	0.98	1.18	4.05	2.75	2.00	0.38	0.80	do.
7761	..	Michipicston	G. Barnston	..	..	..	2.00	1.00	..	1.71	do.	
4909	..	Canada West	D. W. Beadle	..	..	..	..	..	..	..	do.	
7486	..	Hingham, Mass.	Dr. Brewer	..	..	..	..	..	..	..	do.	
10422	..	do	do	..	..	..	..	..	..	..	do.	
10423	..	do	do	..	..	..	..	..	..	..	do.	
10428	..	do	do	..	..	..	..	..	..	..	do.	
10437	..	Nichols, N. Y.	R. Howell	..	..	..	..	..	..	..	Alcoholic; young.	
10438	..	do	do	..	..	..	..	..	..	..	do.	
10442	..	Williamst'n, Mass.	S. H. Scudder	..	..	..	..	..	..	..	do.	
4896	..	Waterville, N. Y.	H. Davis	..	..	..	..	..	..	..	Alcoholic; adult.	
10443	..	do	do	..	..	..	..	..	..	..	do.	
10444	..	do	do	..	..	..	..	..	..	..	do.	
10445	..	do	do	..	..	..	..	..	..	..	do.	
10446	..	Alleghany Co., Pa.	R. L. Walker	..	..	..	..	..	..	..	do.	
10447	..	do	do	..	..	..	..	..	..	..	do.	
10448	..	do	do	..	..	..	..	..	..	..	do.	
7459	..	Spottsylvania Co., Va.	A. W. Massey	..	..	..	..	..	..	..	do.	
10457	..	do	do	..	..	..	..	..	..	..	do.	
10460	..	do	do	..	..	..	..	..	..	..	do.	
7443	..	Pembina, Minn.	R. Kennicott	..	..	..	..	..	..	..	do.	
10461	..	do	do	..	..	..	..	..	..	..	do.	
10462	..	do	do	..	..	..	..	..	..	..	do.	
7757	..	Minnesota	do	..	..	..	..	..	..	..	do.	
7412	..	New Lebanon, Ind.	S. B. Davis	..	..	..	..	..	..	..	do.	
10466	..	do	do	..	..	..	..	..	..	..	do.	
10467	..	do	do	..	..	..	..	..	..	..	do.	
4894	..	do	do	..								

It seems unnecessary for us to examine the figures of this table in detail after what we have said of the Massachusetts lot. Bringing together so many specimens, we find, does not appreciably affect the Jenks' *average*; but it has the inevitable result of spreading the extremes a little farther apart, and proving the range of variation to be rather more than we allowed in the former case—in fact, it demonstrates the variability of the species to be fully as great as claimed by Allen.

Contrary to our expectation, we do not find *in this series* any evidence that *latitude* exerts an appreciable influence upon the absolute size or relative proportion of the parts of this mouse. Nor do we observe any difference with latitude in the character of the pelage, the hairiness of the soles or tail, &c.—at any rate to an appreciable extent—and certainly no such difference as may be observed between summer and winter specimens from the same locality (when we come, however, to bring in Arctic skins, as below, we shall be able to see a difference). In the matter of color, there is positively nothing in this whole series that we cannot exactly match among Massachusetts skins. And yet it is curious to observe that almost every considerable geographical area within the limits represented in the table produces a slight strain or breed of its white-footed mice—some difference in color indescribable in words, but which strikes the eye that is very familiar with the subject. The Nova Scotian animal and the Virginian, the Illinois and the Kansas, are always distinguishable. We venture to assert that we can distinguish in North America about *twenty kinds of Hesperomys leucopus* upon characters at least as constant, reliable, and tangible as those hitherto held to define the greater part of the “species” that have been in vogue of late years.

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The first nominal species that we shall investigate is the *H. “myoides”* of Baird, who described his animal chiefly from Vermont specimens, identifying it with the “*Cricetus myoides*” of Gapper. The only characters ascribed to it are: first, possession of cheek-pouches; secondly, “tail-vertebræ generally 0.25 of an inch longer than head and body.” But we have just shown that the possession of a tail a fourth (or more) of an inch longer than the body has no significance whatever as a specific character; and among the specimens enumerated by Baird (and also tabulated by us) are some with the tail no longer than the body, and others with the tail shorter than the body;

so this character falls to the ground. And to finally settle the question of the actual existence of a species combining check-pouches with a long tail, we will introduce the following table.\*

TABLE XII.—*Fresh measurements of thirty-one specimens of HESPEROMYS "myoides" from Arctic America.*

[All these measurements are from specimens in the flesh, except the seventh column, the feet being measured dry.]

Number.	Sex.	Date.	Locality.	Collector.	Nose to—			Tail to—			Depth of cheek pouch.	Height of ear.	Remarks.
					Eye.	Ear.	Occiput.	Root of tail.	End of vert.	End of hairs.			
4514	♀	1860.	Fort Simpson.....	B. R. Ross.....	.....	.....	4.00	.....	0.80	.....	.....	.....	
4500	♀	Mar. 22	do	do	0.60	1.00	1.10	3.60	3.00	3.15	0.75	0.02	55
4524	♀	Mar. 16	do	do	0.57	0.95	1.00	3.10	2.75	2.00	0.75	0.70	55
4512	♀	Apr. 5	do	do	0.60	1.05	1.20	3.85	3.05	3.25	0.85	.....	
4517	♀	May 6	do	do	.....	.....	4.25	3.10	3.30	0.75	.....	.....	
4527	♀	Mar. 22	do	do	0.65	1.15	1.50	3.00	3.35	3.50	0.80	0.85	63
4526	♀	Mar. 22	do	do	0.60	1.00	1.15	3.50	2.80	3.00	0.80	0.75	60
4515	♀	Apr. 22	do	do	0.55	0.90	1.05	3.00	1.10	2.25	0.77	.....	
4521	♂	May 5	do	do	.....	.....	4.00	2.70	2.90	0.75	.....	.....	
4542	♀	Mar. 22	do	do	0.55	0.95	1.05	3.00	3.80	2.00	0.70	0.60	55
4522	♀	Mar. 22	do	do	0.60	1.10	1.30	3.50	1.90	3.10	0.80	0.60	55
4555	♀	Mar. 31	do	do	0.62	1.04	1.50	3.90	.....	.....	0.85	0.80	65
4519	♀	May 2	do	do	.....	.....	3.60	3.10	3.25	0.70	.....	.....	
4523	♀	Apr. 27	do	do	.....	.....	3.85	2.35	2.50	0.72	.....	.....	
4557	♀	May 22	do	do	.....	.....	1.00	2.20	2.30	0.70	.....	.....	
4511	♀	Apr. 10	do	do	0.55	0.85	1.10	3.70	2.8	3.00	0.80	.....	
4513	♂	Apr. 7	do	do	0.60	1.05	1.15	3.60	2.85	3.05	0.77	.....	
4535	♂	Sept. 6	do	R. Kennicott	0.60	0.90	1.10	3.20	3.30	3.55	0.85	0.85	60
4540	♂	Mar. 13	do	do	0.57	0.90	1.10	3.00	2.58	2.88	0.71	.....	Check-pouch 0.40 to angle of mouth
4554	♀	Sept. 1	do	do	0.60	0.90	1.15	3.50	2.70	2.90	0.75	.....	0.60
4531	♀	Sept. 7	do	do	0.60	0.92	1.10	3.60	3.00	3.25	0.80	0.75	
4530	♀	Sept. 7	do	do	0.58	0.92	1.08	3.00	2.00	3.12	0.78	0.75	
4534	♂	Sept. 7	do	do	0.60	0.98	1.10	3.60	3.00	3.20	0.80	0.80	63
4529	♂	Sept. 7	do	do	0.65	0.98	1.15	3.75	3.00	3.20	0.80	0.70	Check-pouch 0.42 to angle of mouth.
4532	♀	Oct. 18	do	do	.....	.....	1.05	3.50	2.40	3.10	0.78	0.85	
4534	♂	Sept. 6	do	do	0.60	0.90	1.10	3.30	2.60	2.85	0.75	0.75	0.55
4541	♂	Sept. 1	do	do	.....	.....	1.15	3.40	2.50	2.75	0.78	.....	Check-pouch 0.40 to angles of mouth.
4536	♂	Sept. 6	do	do	0.63	0.97	1.10	3.70	3.00	3.25	0.80	0.80	55
4538	♀	May 15	Fort Resolution.....	do	0.60	1.00	1.08	3.40	2.60	2.85	0.78	.....	Check pouch 0.40 to angle of mouth.
4547	♀	Apr. 24	do	do	0.60	0.95	1.05	3.40	2.50	2.75	0.75	.....	
4539	♀	Feb. 15	Fort Liard.....	do	.....	.....	1.20	3.30	3.00	3.25	0.76	.....	
			Average	.....	0.60	0.95	1.15	3.64	3.70	3.00	0.74	0.75	58
			Maximum	.....	0.65	1.17	1.20	4.25	3.35	3.50	0.85	0.87	65
			Minimum	.....	0.55	0.90	1.07	3.00	2.10	2.25	0.70	0.60	55

\* This Arctic series is simply a part of the Arctic series introduced further on. It represents the variety *sonoriensis*, and is only brought in here to show the matter of the cheek-pouches. We have only to remark further, in this place, that the Arctic series averages larger than United States specimens, and has shorter feet and ears, as well as shorter tail.

All the foregoing thirty-one specimens, from substantially the same locality, were labeled "myoides" at the Smithsonian, and the cheek-pouches appear to have been carefully examined by the naturalists who collected the series. The pouches measure from a little less than two-thirds to a little over three-fourths of an inch in depth from the nose, and about half as much in depth from the angle of the mouth. Now these specimens, with an average length of 3.64, have an average tail of 2.70; and in not one does the tail even equal the head and body.

The credit of first showing that *H. leucopus* has cheek-pouches is due to Mr. Allen, whose suggestion that probably all the species of the genus would be found to possess them we have verified in the cases of all the intimate allies of *H. leucopus* examined. Professor Baird, however, had already suspected their existence in this and other species. (Baird, *op. cit.* 472; Allen, *op. cit.* 229.)

Mr. Allen is therefore perfectly right in saying that *H. "myoides"* is "positively identical with *H. leucopus*." It is hardly necessary to add that this determination invalidates the analysis of the genus given by Baird, *op. cit.* 458.

The *Hesperomys "gracilis"* of LeConte is another nominal species. It was referred by Baird to his "myoides" with a query. We have LeConte's type before us; it is tabulated in the foregoing table along with another specimen (No. 4710), also labeled "gracilis"; both are from Ohio, Wisconsin, or Michigan, and are in the gray pelage. The larger one has the tail 3.60 long, just about equal to the body, which latter, however, is stretched, and now is rat-eaten. There is absolutely nothing to distinguish either of these specimens from ordinary *leucopus*. *H. "gracilis, LeConte"* is a taxidermal accident, the specimens having been stuffed so as to look slenderer than usual.

We have before us the type and only known specimen of *Hesperomys "campestris,"* LeC., from New Jersey (No. 4726 of the preceding table). LeConte's description shows nothing whatever different from ordinary *leucopus*, and the specimen bears out the description. The animal is ungrown, and from long immersion in alcohol (out of which it has been lately skinned, in a wretched state of preservation) has lost every trace of its original coloration.

Of two specimens before us from Labrador, one (No. 3924) is labeled "arcticus, Sauss.", and the other (No. 3925) "bairdii, Sauss." We trust that

M. De Saussure has been more fortunate in handling Mexican *Hesperomys* than he was in this case, for one of these specimens is an adult and the other a young example of *leucopus*; neither of them shows the slightest departure from the ordinary type. We have not met with either of these names in print, and if, indeed, they were never published, we shall regret their appearance on our page; for a synonym once rooted is hard to eradicate.

Now, passing over for a moment a certain Eastern United States variety of *leucopus* that we shall be prepared to establish farther on, and likewise postponing consideration of the names "cognatus" and "maniculatus", as these are best treated in connection with var. *gossypinus*, we will examine several western names that we claim have no foundation.

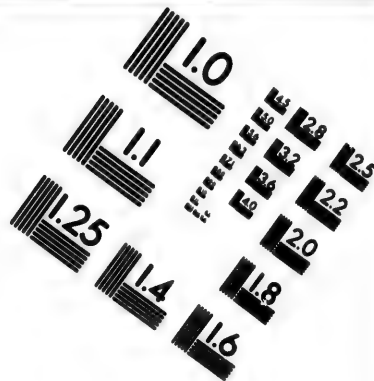
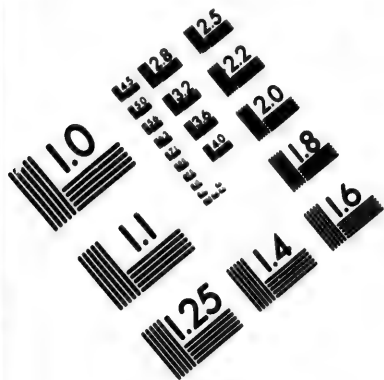
The first western "species" (so-called) that we shall notice, is *Hesperomys* "texanus" of Woodhouse (type, No. 2559, Mus. Smiths., in alcohol, from Western Texas). The author's description shows nothing whatever different from ordinary *leucopus*, except small size (length, 2.10; tail the same); but this, of course, is matched by any other ungrown *leucopus*. The character, "legs white on their inner surface only" (*i. e.*, color of back extending over outside of legs), is not of the slightest consequence, since plenty of typical *leucopus* show it, especially immature ones. In admitting the species, which he places next to *leucopus*, Professor Baird found it "very difficult to characterize it as distinct from *leucopus*, although it is very probable that the two are distinct." He assigns "size and proportions about as in *leucopus*;" and his table of measurements does not show any discrepancy. The ears are *not* smaller, as given by both these authors. We fail to appreciate any distinction in color, except a slight *average* paleness; and for this we shall be abundantly prepared after we have looked up var. *sonoriensis*. Finally, we tabulate the several specimens that have been referred to *texanus*; it is the more surprising that Dr. Woodhouse should have described his specimen as distinct, since he was well acquainted with *leucopus*, which, as he says, is "common in the Indian Territory and Texas."

TABLE XIII.—List of specimens of *Hesperomys "lezanus"* not differing in any respect from ordinary *LEUCOPUS*.

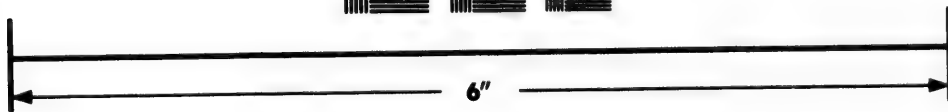
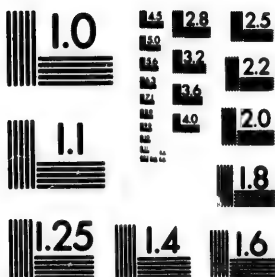
Number.	Locality.	Collector.	Nose to—				Tail vertebrae.	Fore foot.	Hind foot.	Ear.	Remarks.
			Eye.	Ear.	Occiput.	Root of tail.					
6250	Western Texas .....	S. W. Woodhouse .....	0.50	.....	.....	.....	2.40	0.35	0.78	.....	Type; alcoholic.
1736	do .....	J. Pope .....	.....	.....	.....	.....	.....	.....	.....	.....	Very young.
145	El Paso, Tex. ....	J. H. Clark .....	.....	.....	.....	3.75	2.92	.....	0.80	.....	
7490	Brownsville, Tex. ....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
448	Pecos River, Tex. ....	C. B. R. Kennerly .....	.....	.....	.....	.....	.....	.....	.....	.....	
1037	Turkey Creek, Tex. ....	do .....	.....	.....	.....	.....	.....	.....	.....	.....	
1038	do .....	do .....	0.43	0.85	.....	.....	2.05	0.33	0.79	.....	Alcoholic; young.
2077	Texas .....	L. C. Einendberg .....	.....	.....	.....	.....	.....	.....	.....	.....	
5654	Fort Bliss, N. Mex. ....	S. W. Crawford .....	0.50	0.91	1.18	3.40	2.84	0.38	0.89	.....	
10194 to 10130	Fort Conrad, N. Mex. ....	C. B. R. Kennerly .....	.....	.....	.....	.....	.....	.....	.....	.....	
1734	Waco Tanks, N. Mex. ....	J. Pope .....	.....	.....	.....	.....	.....	.....	.....	.....	Alcoholic.
579	Charco Escondido .....	D. N. Couch .....	.....	.....	.....	2.70	2.65	.....	0.80	.....	
9916	Fort Conrad, N. Mex. ....	C. B. R. Kennerly .....	0.41	0.90	1.10	3.40	3.80	0.35	0.71	0.54	
7466	Matamoros, Mexico .....	D. N. Couch .....	.....	.....	.....	2.40	2.50	.....	.....	.....	
10314	do .....	do .....	.....	.....	.....	.....	.....	.....	.....	.....	
10315	do .....	do .....	.....	.....	.....	.....	.....	.....	.....	.....	do.
10316	do .....	do .....	.....	.....	.....	.....	.....	.....	.....	.....	do.

We now desire to invite attention to the supposed species named *Hesperomys* "gambeli", in proposing which Professor Baird remarks pertinently:—"This species, in size and general appearance, represents very closely the *Hesperomys leucopus* of the Eastern States, to such degree, in fact, that I have not found any easily-expressed characters to separate them." We ourselves fail to appreciate any differences whatever that are applicable to even a fair proportion of the specimens examined, though some are paler than ordinary *leucopus*; we cannot even make Professor Baird's qualified expressions hold good. This, however, being merely our opinion, good for what it may be worth, we are called upon to prove the point. With all the original specimens and many additional ones before us, we first present a table, and will then discuss the same.





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TABLE XIV.—Measurements of about fifty (and list of other) specimens purporting to be *Hesperomys "Gambeli"* from Washington and Oregon Territories and California.

Number.	Locality.	Collector.	Nose to—				Tail vertebrae.	Fore foot.	Hind foot.	Ear.	Remarks.
			Eye.	Ear.	Head.	Root of tail.					
10136	Port Townsend	G. Suckley									Alcoholic; young.
7453	do	do	0.50	0.90	1.08	3.30	3.30	0.33	0.83	0.65	Alcoholic.
663	Cascade M'ts. Wash.	do				3.50	2.85		0.77	0.65	Dry.
810	Astoria, Oreg. Ter	Lieut. Trowbridge				4.00	3.65		0.84	0.63	do
998	Fort Dallas, Oreg. Ter	G. Suckley				3.83			0.70	0.68	do
1362	Klamath Lake	J. S. Newberry				3.25			0.75	0.55	do
3176	Simishmo, Wash. Ter.	C. B. R. Kennerly				3.80	3.00		0.76	0.65	do
3179	do	do				3.40	2.90		0.78	0.64	do
3315	do	do				3.60	3.40		0.80	0.54	do
284	San Francisco	R. D. Cutts				3.50	2.70		0.80	0.55	do
14706	California	J. LeCoute*				3.25	3.00	0.37	0.92	0.70	do
14707	do	do				3.10	2.90	0.31	0.80	0.65	do
368	Monterey, Cal.	Lieut. Trowbridge				3.60	2.68		0.73	0.55	do
369	do	do				3.50	3.00		0.80	0.56	do
476	Pose Creek, Cal.	A. L. Heermann									do
477	do	do				2.75	2.25		0.80		do
478	do	do									do
2561	Petaluma, Cal.	E. Samuels	0.49	0.80	1.03	2.75	2.50	0.33	0.75		Alcoholic.
2562	do	do	0.45	0.85	1.05	2.50	2.64	0.36	0.80		do
2563	do	do	0.44	0.80	1.02	2.50	2.30	0.34	0.75		do
2564	do	do	0.52	0.92	1.12	3.10	2.80	0.40	0.80		do
2565	do	do	0.50	0.92	1.13	3.25	2.75	0.38	0.80		do
2566	do	do	0.47	0.83							do
2567	do	do	0.50	0.90	1.10	3.10	3.00	0.39	0.78		do
2568	do	do	0.45	0.80	1.07		2.80	0.30	0.80		do
2569	do	do	0.46	0.80	1.14	2.75	2.80	0.32	0.78		do
2570	do	do	0.45	0.78	0.95	2.95	2.00	0.30	0.75		do
10131	do	do									Alcoholic; young.
10135	do	do									do
3671	Fort Tejon, Cal.	J. Xantus				3.50	3.10		0.76	0.55	Dry.
3672	do	do				4.00	3.10		0.81	0.56	do
3673	do	do									do
3674	do	do									do
3675	do	do				3.30	2.70		0.74	0.56	do
3676	do	do									do
7183	California	J. O. Cooper				3.00	2.75		0.65		do
7184	do	do				2.90	2.50		0.77		do
7185	San Diego, Cal.	do	0.50	0.87	1.25	3.50	2.70	0.38	0.79	0.50	Fresh.
7186	Colorado River, Cal.	do	0.50	0.90	1.20	3.60	3.10	0.35	0.75	0.50	do
10317	Fort Mojave	H. B. Mohrhausen	0.52	0.93	1.16	3.75	3.40		0.82	0.60	Alcoholic.
10318	do	do				3.40	3.30				do
10319	do	do									do
10320	do	do									do
10324	do	do	0.54	0.90	1.15	3.25	3.60	0.32	0.78	0.65	do
10962	do	do	0.55	1.00	1.23	3.75	3.25	0.36	0.81	0.68	do
7465	Washington Territory	C. B. R. Kennerly									do

\* LeCoute's specimens show dusky at base of metatarsus; so does 7184.

† These specimens of Dr. Kennerly's are particularly interesting. We bring them in here because we have prepared no separate table for "boylii"; but most of them in fact belong to that style, all those at least with the tail over 3.50. Observe how that in these fourteen specimens the tail ranges from half an inch shorter to over half an inch longer than the body, and how it is graduated by tenths of inches. Observe, also, the discrepancies in the size of the feet and ears. These measurements, being all alcoholic, are perfectly reliable. It is as impossible to draw a line anywhere between these specimens as it is to separate the Vermont long-tailed mice from those of the rest of New England. This is only a part of our series from this locality. We have also numbers 10145 to 10163, which we have deemed it unnecessary to measure or present in a tabular form, as they simply show the same thing.

TABLE XIV.—Measurements of about fifty (and list of other) specimens purporting to be *HESPEROMYS* "GAMBELI" from Washington and Oregon Territories and California—Continued.

Number.	Locality.	Collector.	Nose to—				Tail vertebrae.	Fore foot.	Hind foot.	Ear.	Remarks.
			Eye.	Ear.	Head.	Root of tail.					
7444	Simishran.....	C. B. R. Kennerly				3.35	3.40		0.80	0.62	Alcoholic.
5042	Puget Sound.....	do				3.00	3.00		0.73	0.63	do.
5049	Steilacoom.....	do				3.00	2.90		0.75	0.62	do.
9913	do.....	do				3.00	3.00		0.85	0.65	do.
5033	do.....	do				3.25	3.10		0.79	0.68	do.
5034	Puget Sound.....	do				2.70	2.80		0.70	0.60	do.
10136	do.....	do				3.10	3.15		0.80	0.60	do.
10139	do.....	do				3.25	3.30		0.82	0.66	do.
10140	do.....	do				3.30	3.60		0.84	0.74	do.
10141	do.....	do				3.90	3.75		0.90	0.68	do.
10142	do.....	do				3.35	3.60		0.75	0.65	do.
10143	do.....	do				3.10	3.80		0.83	0.75	do.
10144	do.....	do				3.40	4.00		0.92	0.78	do.
7473	Fort Tejon, Cal.....	J. Xantus.....	0.46	0.79	1.07	2.90	2.60	0.33	0.80	0.60	do.
10164	do.....	do									do.
10175	do.....	do									do.
10801	do.....	do									do.
10827	do.....	do									do.
7765	do.....	do	0.55	0.93	1.90	3.90	2.70	0.35	0.83	0.66	do.
7460	do.....	do	0.50	0.90	1.18	3.50	3.30	0.33	0.81	0.68	do.
4991	Fort Umpqua, Oreg....	E. P. Vollum *				3.40	4.40		0.92	0.67	do.
10806	do.....	do				3.50	3.50		0.81	0.67	do.
10807	do.....	do									do.
10301	do.....	do									do.

\* Three specimens of Dr. Vollum's bear out the remarks made under Dr. Kennerly's. One of them is referable to "boylii"; the rest are apparently "gambeli".

The foregoing table is to be compared with the following items in the original diagnosis of "gambeli":—"Very similar to *H. leucopus* in size and proportions." This is true, even without the qualification. "*Feet perhaps shorter.*" This is not so; the feet are wholly within the range of variation of eastern *leucopus*, and the average of the foregoing table is within an inappreciable fraction (0.01 or 0.02) of the eastern average. "*Ears larger.*" The largest ear in the series is not over the length of a large percentage of the eastern series; all the ears are within the eastern limits of variation, and the average ear is within an inappreciable fraction (0.02 or 0.03) of the eastern average. "*Tail generally less than the head and body, sometimes a very little longer.*" This expression is precisely diagnostic of typical *leucopus*. "*Above yellowish-brown, much mixed with dusky, but without a distinct broad wash of darker on the back.*" Most of the specimens really are paler and more uniform on the back than in average

*leucopus*, and this is particularly evident in those from the open, dryer parts of Southern California, and especially such examples as No. 7185 from the Colorado Desert region, where the coloration is a brisk fulvous, without dorsal stripe. But nearly all the specimens can be matched by eastern examples; and, moreover, all the northern ones are actually darker than average *leucopus*, while most of them show a distinct dorsal stripe. "*The entire outside of the fore leg below the shoulder white?*" In a part of the specimens this is so, and in another part of the specimens it is not so; and the same is the case with ordinary *leucopus*. It is evident, therefore, that the characters ascribed to the supposed "gambeli" fall to the ground.

Passing now to another Pacific-coast species, so-called, we will premise that in establishing his *H. "austerus"*, Professor Baird intimated his suspicion that it might not prove valid. "It is barely possible," he says, "that my *H. austerus* may be a northern variety of the common Californian species" (*h. e.*, "gambeli"), "of smaller size and darker color, somewhat like the gray and smaller *H. leucopus* of Nova Scotia and probably Labrador, \* \* and further materials will be necessary to decide the question." With the necessary additional material before us, we cannot only confirm the suggestion here made, but we can also show a perfect intergradation between "gambeli" and "austerus"; a melting of this last into "boyliei"; and, finally, the positive identity of "boyliei" with "myoides", which last we have proved to be the same as *leucopus*.

The Simiahmoo specimens, which are, as we have just shown, referable to "gambeli", are so much darker than "gambeli" from the dry, open parts of California, that they stand rather nearer "austerus" in color than to the former examples of the species they are supposed to belong to! Color thus giving us nothing tangible, we will interrogate dimensions, and see if these show anything of specific value. We accordingly present a short table; most of our samples of supposed "austerus" being immature, and therefore excluded as tending to vitiate the result.

TABLE XV.—Measurements of twelve specimens purporting to be *Hesperomys "AUSTERUS"*.

Number.	Locality.	Collector.	Nose to—				Tail to end of—		Fore foot.	Hind foot.	Ear.	Remarks.
			Eye.	Ear.	Occiput.	Tail.	Vertebrae.	Hairs.				
2576	Stellacoom, Wash. Ter.....	G. Buckley.....	0.58	1.00	1.18	.....	3.25	.....	0.49	0.80	.....	Alcoholic.
2577	.....do.....	.....do.....	0.46	0.87	1.08	2.87	2.75	.....	0.33	0.73	.....	Alcoholic.
2578	.....do.....	.....do.....	0.54	1.00	1.20	3.10	3.20	.....	0.34	0.70	.....	Alcoholic.
2579	.....do.....	.....do.....	0.40	0.70	0.86	1.80	1.38	.....	0.27	0.60	.....	Alc.; young.
2580	.....do.....	.....do.....	0.35	0.68	0.83	1.85	1.50	.....	0.28	0.56	.....	Alc.; young.
2580	Vancouver's Island.....	A. W. Howson.....	0.43	0.80	1.00	2.40	2.40	.....	0.35	0.70	.....	Alcoholic.
2587	Washington Territory.....	J. G. Swan.....	.....	.....	.....	3.10	3.70	.....	0.76	0.68	.....	Dry.
259	Spokane, Wash. Ter.....	J. G. Cooper.....	.....	.....	.....	3.00	2.80	.....	0.77	0.59	.....	Dry.
216	Puget Sound, Wash. Ter.....	G. Buckley.....	.....	.....	.....	2.75	3.08	.....	0.83	0.49	.....	Dry.
1964	.....do.....	.....do.....	.....	.....	.....	3.00	3.40	.....	0.83	0.64	.....	Dry.
364	.....do.....	.....do.....	.....	.....	.....	3.00	2.85	.....	0.79	0.58	.....	Dry.
385	.....do.....	.....do.....	.....	.....	.....	3.10	2.40	.....	0.75	0.45	.....	Dry.

\* T is specimen is remarkably blackish, with very pure white feet, and seen by itself would readily suggest a distinction of species from ordinary *leucopus*. It is the extreme of the "austerus" style.

This little table is curious and suggestive. The twelve specimens happen to differ among themselves in size and proportions nearly as much as the whole eastern series of *leucopus* does, and show more variation than would be required to establish several distinct species upon the slight basis that has been often employed. And after allowing a wide margin for chances of error in measurement (always a safe thing to do in dealing with stuffed skins of small mammals), discrepancies remain that cannot be explained away. The tail varies an inch, and the ears and feet are quite as variable. To sum up (with special reference to "boylii", that we are about to discuss): The tail, compared with the trunk, ranges from less than the average of eastern *leucopus* up to nearly the average of "myoides" or "boylii". The ears range from the smallest of *leucopus* to the largest of "boylii". The feet have the ordinary range of either *leucopus* or "boylii". Nothing further is needed to prove our point.

In analyzing our species of *Hesperomys*, Professor Baird put "myoides" and "boylii" together, because they agreed in a length of tail exceeding the average of true *leucopus*. Of "boylii" he says:—"No cheek-pouches! Tail three-quarters of an inch longer than the [head and] body"; and of "myoides":—"With cheek-pouches. Tail a quarter of an inch longer than the head and body." The supposed distinctions of color do not hold; for No. 1313 ("myoides", Burlington, Vt.) and No. 578 ("boylii", Shoalwater Bay) are almost precisely alike in color—much more so than two specimens of "boylii" (No. 578 and No. 356, for example) are. No. 356, the type of "boylii", is the very

tawniest specimen we have ever seen from Washington Territory, and in this respect exactly like some Massachusetts examples of *leucopus*. Color, then, affording no data, and the matter of the cheek-pouches being already settled, we are driven back upon measurements alone to substantiate "boylii"; and we conclude our argument with the following table, comment upon which is unnecessary:—

TABLE XVI.—Measurements of five specimens of five "species" (so-called) of *HESPEROMYS*.

Number.	Supposed species.	Trunk.	Tail.	Sole.	Ear.
2778	Typical of <i>leucopus</i> .....	3.45	3.50	0.83	0.61
356	Type of "boylii".....	3.25*	3.80	0.85	0.60
1313	Typical of "myoides".....	3.50	3.90	0.85	0.61
1994	Typical of "austerns".....	3.00	3.40	0.82	0.64
10292	Type of "gracilis".....	†1	3.60	0.67	.....

\* Printed in M. N. A. "5.25" by typographical error.—A second specimen of "boylii" (No. 578) shows longer tail, feet, and ears:—trunk, 3.08; tail, 4.08; sole, 0.95; ear, 0.75; while a third (No. 810) has the tail considerably shorter than the trunk (trunk, 4.00; tail, 3.65). Professor Baird remarks of this No. 810, that possibly it is "gambeli", and prints it also under "gambeli", with the remark, "possibly H. boylii". It is, in fact, just as much like one as like the other.

† Probably about 3.50, but impossible to determine now, owing to the stretched and rat-eaten state of the specimen.

A series of alcoholic specimens from Cape Saint Lucas, the first examined, we believe, from this locality, offers some interesting features. Although it is not easy to judge of color in their present condition, they appear to be light-colored, with the dorsal stripe of the tail very narrow, and in this and other respects most of the series are undoubtedly referable to "gambeli". A part of the series, however, shows an extraordinary length of the tail—in this respect surpassing the most marked examples of "boylii" or "myoides". In one specimen, the tail is nearly an inch and a half longer than the head, and in this one, as well as the rest of those with the tail decidedly longer than the body, this member is almost as naked as in a *Mus*, and unicolor, of a dull-grayish hue. In all these, the dark color of the leg extends on the base of the metatarsus—a feature shown distinctly even in a suckling specimen. Although in their present state these specimens do not show any appreciable difference in the body-colors from the "gambeli" composing most of the series, we have little hesitation in referring them to the *H. aztecus*. The length of tail of this species, it will be seen beyond, has not been known; for all three of De Saussure's types had lost the tip of the tail. Our type of *aztecus*, received from De Saussure, agrees precisely with

the specimens from Cape Saint Lucas in the nakedness of the tail and extension of the dusky on the metatarsus—the latter being one of the essential features of the species as compared with *leucopus*. In length of tail alone, these specimens grade into the “gambeli” with which they are associated; yet, the other features being perfectly tangible and distinctive, we shall refer the specimens in question to *aztecus*, with no reasonable doubt of the correctness of so doing.

As Mr. Xantus collected extensively on the west coast of Mexico, as well as in Lower California, it is possible that these examples of *aztecus* have been accidentally mixed with his Saint Lucas collections.

The following table gives the measurements of a part of the specimens referable to *leucopus* (“gambeli”) with measurements of some of them. Those representing *aztecus* will be found under the head of the latter.

TABLE XVII.—List of specimens of *H. LEUCOPUS* (“gambeli”) from Cape Saint Lucas, collected by J. Xantus, with measurements.

Catal No.	Locality.	From tip of nose to—				Tail to end of—		Length of—		Height of ear.	Nature of specimen.
		Eye.	Ear.	Occiput.	Tail.	Vertebrae.	Hairs.	Fore foot.	Hind foot.		
4980	Cape Saint Lucas..	0.50	0.90	1.90	3.10	3.10	3.90	0.38	0.83	0.67	Alcoholic.
4981	.....do.....	0.52	0.92	1.15	3.40	3.35	3.45	0.37	0.81	0.67	Alcoholic.
4982	.....do.....	0.54	0.94	1.15	3.60	3.15	3.25	0.40	0.87	0.70	Alcoholic.
10331 to 10346	.....do.....										Alcoholic.

Having exhausted the data at our disposal respecting the nominal species of *Hesperomys* (except “cognatus”, noticed below) that are referable to *leucopus*, we are prepared to bring out three geographical races or varieties that are distinct enough, we think, in their strongest development at least, to merit varietal names, although (we wish it distinctly understood) they pass insensibly into ordinary *leucopus*. These three are *gossypinus*, *sonoriensis*, and *eremicus*. The first of these is nearest *leucopus*, and is hard to define satisfactorily. The second is better marked, and, in its extreme, readily discriminated from *leucopus*, though comparison of some hundreds of specimens show a perfect transition into the latter. The third is strongly marked as a local race, and might be held, with much show of reason, as a good species, as, in fact, we considered it until we saw intermediate specimens.



### HESPEROMYS LEUCOPUS GOSSYPINUS (LeC.).

*Hesperomys gossypinus*, LeCONTE, Proc. Acad. Nat. Sci. Phila. vi, 1853, 411 (Georgia).—BAIRD, M. N. A. 1857, 469 (Georgia and South Carolina).—ALLEN, Bull. Mus. Comp. Zool. ii, 1870, 180 (Florida).  
*Hesperomys* (*Vesperimus*) *leucopus gossypinus*, COUES, Proc. Acad. Nat. Sci. Phila. 1874, 179.  
*Hypudaeus gossypinus*, LeCONTE, McMurtrie's Cuvier, i, 434, app.—AUD. & BACH., Q. N. A. i, 306 (in text; consider it as a var. of *leucopus*).

DIAGNOSIS.—*H. staturâ H. leucopus excedens* (4-poll.), *caudâ breviorē ferè unicolore, pedibus majoribus* (subpoll.), *coloribus obscurioribus*.

HABITAT.—South Atlantic States. Kansas?

Mouse larger than *H. leucopus* (some four inches long), with a shorter tail, but little paler below than above; hind feet nine-tenths of an inch; fur of the upper parts dark rusty-brown, and of the under parts not pure white.

The few specimens below enumerated show some tangible differences from ordinary *leucopus*, as expressed in the foregoing paragraphs. Besides averaging in stature a dimension that *leucopus* very rarely attains, the tail is absolutely shorter than in the average of that species, and therefore proportionally still less. It is, moreover, nearly unicolor in some specimens; in others, however, it is evidently, but not sharply, bicolor. The hind feet are about 0.90 long, a dimension that *leucopus* only reaches in exceptional cases. The general colors are much darker, and, perhaps, never of the bright fulvous of typical *leucopus*; it is much as if the darker dorsal wash of *leucopus* was spread over all the upper parts. Correspondingly, the under parts are dull soiled whitish, or white with an ashy-gray hue.

Our specimens are obviously too few for a final conclusion, and we have been much perplexed to determine how to treat this form. All the seven below given are distinguishable at a glance from *leucopus*; but our suspicion is very strong, indeed, that if we had, say fifty instead of seven examples, some of them would be indistinguishable from *leucopus*, and others would show indissoluble connection. This was the mature opinion of Audubon and Bachman, who say:—"We were for several years disposed to regard it as distinct, and have, not without much hesitation, and after an examination of many hundred specimens, been induced to set it down as a variety only." Mr. Allen (*l. c.*) allows the name to head his paragraph, but expressly states his belief that it is not a valid species, both in this place and in a previous paper (Bull. Mus. Comp. Zool. i, 1869, 229). Under the circumstances, we judge that nature will be the more faithfully reflected to consider *H. gossypinus* as a variety of *leucopus*,

ranking nearly with *sonoriensis* as to the degree of geographical differentiation that it has sustained.

The propriety of this step will appear in still stronger light after examination of the so-called "*Hesperomys cognatus*" of LeConte and Baird, which we are now prepared to discuss. Apart from the published accounts of the two authors just named, our material is, first, three dried specimens, labeled "*cognatus*" in what we presume to be Major LeConte's own handwriting, as it is the same as that upon his other types now in our possession; secondly, five dried and several alcoholic specimens referred to this species by Baird, *l. c.* The latter will be first noticed.

Two of these, Nos. 673 and 905, from North and South Carolina, respectively, are precisely like *leucopus* in every respect, except that the tails of both are much less distinctly bicolor than usual in *leucopus*. Out of our series, however, of unquestioned and unquestionable *leucopus*, we can *precisely match* this feature. The other three specimens are from Mississippi (Nos. 562, 583, 586). They are all in wretched condition, having been skinned out of alcohol. One of them, 562, is not half grown (body, 2.25; tail, 1.42, &c.); it is dark lead-color, and from the shortness of the tail represents *sonoriensis*, if anything different from *leucopus*. The second is nearly grown, but still in the mouse-gray pelage; the tail is 2.50 to a body of 3.00, and therefore not shorter in proportion than in *leucopus*; and the tail is *very sharply bicolor*. The third appears grown, but the colors are indeterminable, from immersion in alcohol and from loss of most of the fur; the tail is plainly bicolor; the proportions are just as in an average of *leucopus*. We must confess that, even if there were a species "*cognatus*" distinct from *leucopus*, we do not see how these five specimens could be taken to represent it. Much as we regret our decision, we must say that they are all unquestionably *leucopus*.

The remaining specimens (alcoholic) we cannot distinguish even as a tangible variety of *leucopus*.

Major LeConte's types do not seem to have been in Professor Baird's hands when the article on the Mammals of North America was being prepared; and the latter had to guess at the former's meaning—a difficult matter indeed, since Major LeConte's description amounts to exactly nothing. Of his three specimens, one of them (from Illinois), we find to our great surprise, is an example of *H. michiganensis*, pure and simple! (Head and body, 2.90; tail, 1.90, sharply bicolor; hind foot, 0.66; &c.) The other two, Nos. 4708,

4709, are not marked for locality, but probably came from Ohio, Wisconsin, or Michigan, and are really his types. They are exactly the size of ordinary *leucopus*; the tail a little shorter, relatively, than the average of *leucopus*, but not shorter than is often found in *leucopus*; and they are colored exactly as in *gossypinus*, the upper parts being very dark, the under impure white, and the tail indistinctly bicolor.

Here, then, is an exactly intermediate form between *leucopus* and *gossypinus*, proving that the latter cannot properly be regarded as specifically different from the former.

It is obviously a matter of indifference where we make our break in the chain between the two; i. e., whether we assign the links "cognatus" to one or the other. Practically, however, it will be found most convenient to assign "cognatus LeC." to *leucopus*, so that we only recognize the extreme of differentiation in *gossypinus*. This course is the more commendable, since "cognatus Baird", based as above explained, is assuredly *leucopus*.

TABLE XVIII.—List of specimens of *HESPEROMYS LEUCOPUS* var. *GOSSYPINUS*.

Number.	Locality.	Received from.	Nose to tail.	Tail to end of vertebrae.	Hind feet.	Nature of specimen.
4705	Georgia .....	J. LeConte .....	4.00	2.90	0.86	Dry.
4711	.....do .....	.....do .....	4.25	2.50	0.90	Dry.
546	.....do .....	.....do .....	4.50	2.05	0.90	Dry.
4817	.....do .....	Dr. Gesner .....	3.50	3.00	0.88	Alcoholic.
10086	.....do .....	.....do .....	3.90	2.90	0.87	Alcoholic.
1361	South Carolina .....	W. Cooper .....	4.00	2.35	0.89	Dry.
8537	West Kansas * .....	A. Crocker .....	4.50	3.00	0.90	Dry.

\* We hesitate in the determination of this specimen, since part of its size is due to overstuffing; the under parts are white, and the tail sharply bicolor; the locality, too, is against the supposition that it is *gossypinus*; and it is accompanied by other Kansas specimens that we cannot determine, and some that are certainly pure *leucopus*. In the length of the feet, however, and in general coloration, it seems to agree better with *gossypinus* than with true *leucopus*. Dr. Gesner's specimens, likewise, we refer here on account of locality and their large size, though the mouth, feet, and tail underneath, are very pure white, and the under parts nearly so. (These specimens are both males, and exhibit the maximum development of the testes we have ever seen in the species. The glands form an immense bulging mass on the testes, about  $\frac{1}{2}$  long by  $\frac{1}{2}$  wide, of flattened, oblong shape, quite sharp-pointed behind, and mostly divided by a deep median raphe.)

## HESPEROMYS LEUCOPUS SONORIENSIS (LeC.).

*Mus leucopus*, RICHARDSON, Zool. Journ. iii, 1818; Fu. Bor.-Am. i, 1839, 143.  
*Hesperomys sonoriensis*, LeCOMTE, Proc. Acad. Nat. Sci. Phila. vi, 1853, 413 (Sonora; type, No. 146, Mus. Smiths.).—AUD. & BACH., Q. N. A. iii, 1854, 296 (after LeConte).—BAIRD, M. N. A. 1857, 474; U. S. & Mex. Bound. Surv. ii, pt. ii, 1859, 43.  
*Hesperomys (Vesperimus) leucopus sonoriensis*, COUES, Proc. Acad. Nat. Sci. Phila. 1874, 179.  
*Hesperomys sonoriensis* var. *nebrascensis*, BAIRD, M. N. A. 1857, 402, in text (based on the below-enumerated Nebraskan examples).

DIAGNOSIS.—*Hesp. leucopus* vix differt nisi caudâ breviorē, truncum sine capite subæquante, necnon coloribus dilutioribus in speciminibus meridionalibus, in arcticis obscurioribus minime fulvescentibus.

A variety of *Hesperomys leucopus*, differing in having the tail shorter (only about equal to the body without the head), and the colors either paler as in prairie specimens, or darker as in Arctic examples, but neither of these exhibiting the particular coloration of typical *leucopus*.

HABITAT.—Interior of North America, west of the Mississippi, from the Arctic regions to Mexico; usually occupying this range to the exclusion of true *leucopus*, but in some places mixed therewith.

It only remains to discuss the intricate question touching the White-footed Mice from the interior of North America. We approach this subject with a full knowledge of the normal variability of *leucopus*, after settling the eastern and Pacific varieties, and in possession of hundreds of specimens from all localities, among them the type of *sonoriensis*. Only a part of our material appears in the following tables, the rest being ineligible on account of immaturity, bad taxidermy, and other causes.

The type of *sonoriensis* (No. 146, Mus. Smiths.) is a young animal about three fourths grown, in a gray pelage identical with that of the same age of *leucopus*. While nothing, therefore, can be predicated upon its absolute size or its color, it may be known at a glance from ordinary *leucopus* by the shortness of the tail; this member falling short of two inches, which is never the case with even three-fourths grown *leucopus*, so far as we know. The trunk measures 3.25, the tail 1.93; and after allowing for stretching, we may safely say that the tail is more than an inch shorter than the trunk.

The following table shows that this same short-tailedness marks a large proportion of the mice from the regions indicated. While the average length of the series from the United States is about 3.25, the tail averages only about 2.25, and several tails, as of Nos. 1782, 1932, 3149, 3352, &c., fall

under 2.00; most tails range between 2.00 and 2.50, and not a tail touches 3.00, which last is an ordinary length of tail for true *leucopus*. The feet give no data (ranging from 0.65 to 0.77, with an average of about 0.77), neither do the ears. The shorter tail, *on an average*, is the sole datum as far as form is concerned.

Close scrutiny of the table, however, shows that a considerable part of the series has the tail equally or even exceeding the *average* of *leucopus*. Secondly, this feature does not obtain in all the specimens from any given locality; thus, No. 1932, with the shortest tail in the lot, is associated in Kansas with veritable *leucopus*; Nebraskan examples range from 1.75 to 2.75 in length of tail; Utah ones from 1.80 to 2.30; Fort Crook ones about the same; New Mexican and Sonoran ones from 1.93 to 2.65.\* In short, we find in almost every locality a greater difference in the several tails than that distinguishing them collectively from *leucopus*; and we can only say that they *average* half an inch less than the average of *leucopus*, about equaling the trunk alone instead of about equaling the trunk plus three-quarters of the head.

As this finishes what we have to say of the form of these western United States mice, we here insert our table, and then take up some other points.

TABLE XIX.—Measurements of eighty-one (and list of other) specimens of supposed *Hesperomys leucopus sonoriensis* from the Middle Region, United States.

[N. B.—Many of these specimens are not fairly distinguishable from ordinary *leucopus*.]

Number.	Locality.	Collector.	Nose to—			Tail to end of—		Fore foot.	Hind foot.	Ear.	Remarks.
			Eyes.	Ear.	Occiput.	Tail.	Vert.	Hairs.			
9338	Fort Ellis, Mont. ....	F. V. Hayden .....	.....	.....	.....	2.75	2.20	.....	0.75	.....	Dry.
4300	Near Platte River .....	.....do.....	.....	.....	.....	4.00	2.40	.....	0.78	.....	Dry; stretched.
4310	Deer Creek, Nebr. ....	.....do.....	.....	.....	.....	3.70	2.40	.....	0.78	.....	Dry.
4311	.....do.....	.....do.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1368	Little Missouri River.....	.....do.....	.....	.....	.....	4.00	2.40	.....	0.77	.....	Dry.
1369	.....do.....	.....do.....	.....	.....	.....	1.00	2.40	.....	0.77	.....	.....do.
1060	.....do.....	.....do.....	.....	.....	.....	1.00	2.75	.....	0.75	.....	Alcoholic.
651	Fort Pierre, Dak. ....	.....do.....	0.45	0.80	.....	2.75	2.30	0.33	0.75	.....	Dry.*
798	.....do.....	.....do.....	.....	.....	.....	3.25	2.50	.....	0.80	.....	.....do.*
703	.....do.....	.....do.....	.....	.....	.....	1.17	3.00	.....	0.77	.....	.....do.*
1779	Yellowstone River.....	.....do.....	.....	.....	.....	1.00	2.75	.....	0.74	.....	Dry.
1780	.....do.....	.....do.....	.....	.....	.....	2.80	2.10	.....	0.76	.....	Dry; young.
1781	.....do.....	.....do.....	.....	.....	.....	.....	.....	.....	.....	.....	.....do.
1782	.....do.....	.....do.....	.....	.....	.....	3.40	1.75	.....	0.80	.....	Dry.
1783	.....do.....	.....do.....	.....	.....	.....	.....	.....	.....	.....	.....	.....do.

\* These seem to be *leucopus*.

\* Really from 1.93 to 3.06! For No. 145, collected by Mr. Clark on the Mexican Boundary, showed a tail of 3.05, and so had to be turned over to "texanus".

TABLE XIX.—Measurements of eighty-one (and list of other) specimens of supposed *Hesperomys leucopus sonoriensis* from the Middle Region, United States—Continued.

Number.	Locality.	Collector.	Nose to—			Tail to end of—			Hind foot.	Ear.	Remarks.
			Eye.	Ear.	Occipit.	Tail.	Vert.	Navis.			
1764	Yellowstone River.....	F. V. Hayden.....									Dry.
10401	to	do.....									do.
10416	"Nebraska".....	do.....									do.
7478	Fort Bridge, Utah.....	C. Drexler.....				3.00	2.50		0.61		Alcoholic.
10028	do.....	do.....									do.
10045	do.....	do.....									do.
3334	do.....	do.....				3.00	3.00		0.71		Dry.
3335	do.....	do.....				3.22	1.40		1.71		do.
3334	do.....	do.....				3.00	3.00		1.71		do.
3337	do.....	do.....				4.00	4.3		1.71		do.
3336	do.....	do.....				3.70	3.00		1.73		do.
3359	do.....	do.....				1.90	4.30		0.8		do.
3636	Fort Creek, Cal.....	J. Fellner.....				4.85	4.35		1.71		do.
3850	do.....	do.....				3.9	3.00		1.81		Dry; stretched.
3860	do.....	do.....				3.00	3.50		1.70		Dry.
3861	do.....	do.....				4.00	3.90		0.70		do.
3788	do.....	do.....				2.75	1.60		0.73		ry; young.
3863	do.....	do.....				2.75	1.60		0.73		do.
4173	do.....	do.....				1.90			0.73		do.
7764	do.....	do.....	0.50	0.07	1.15	3.2	3.40		0.74		do.
10490	do.....	D. F. Parkinson.....				1.55	2.50		0.73		Dry.
3331	Camp Burgwyn, N. Mex.....	W. W. Anderson.....				3.90	3.30		0.77		Dry; stretched.
3329	do.....	do.....				3.40	1.90		0.73		do.
3748	do.....	do.....				4.00	1.00		0.73		do.
3749	do.....	do.....				3.75	1.90		0.73		do.
548	Fort Thorn, N. Mex.....	T. C. Henry.....				3.75	2.35		0.75		do.
543	do.....	do.....				3.70	2.35		0.76		do.
544	do.....	do.....				3.80	2.2		1.71		do.
545	do.....	do.....				3.85	2.10		0.60		do.
144	Sonora.....	J. H. Clarke.....				3.75	2.45		0.80		Dry; <i>leucopus</i> ?
146	do.....	do.....				3.85	1.95		0.75		Dry; type of <i>sonoriensis</i> .
147	do.....	do.....									Dry; young.
9729	Wyoming.....	H. D. Schmidt.....				3.60	2.35				Dry.
9734	do.....	do.....									do.
9735	do.....	do.....									do.
9736	do.....	do.....									do.
9549	Milk River, Dak.....	do.....	0.07			3.30	2.71		0.35	0.79	Alcoholic.
9543	do.....	do.....	1.32			1.75	4.0	2.0	0.35	0.60	do.
9544	do.....	do.....	0.50	0.03	1.13	3.0	2.11		0.3	0.63	do.
9545	Near Yellowstone River.....	do.....	0.50	0.01	1.1	3.00	2.51		0.0	0.65	do.
9546	do.....	do.....	0.52	0.00	1.13	3.00	2.12		0.60		do.
9547	do.....	do.....	0.47	0.00	0.99	3.30	2.63		0.65		do.
9548	do.....	do.....	0.47	0.05	1.04	2.60	1.65		0.35	0.75	do.
9590	Yellowstone River.....	do.....	0.50	0.05	1.15	3.18	2.93		0.36	0.75	do.
9551	do.....	do.....	0.53	1.00	1.75	1.9	2.40		0.4	0.64	do.
9558	do.....	do.....	0.50	0.05	1.15	3.10	2.40		0.40	0.74	do.
9553	do.....	do.....	0.50	0.00	1.05	2.75	2.45		0.30	0.75	do.
9554	do.....	do.....	0.50	0.00	1.07	2.65	2.00		0.40	0.77	do.
9555	do.....	do.....	0.52	1.00	1.10	3.00	2.50		0.45	0.68	do.
9556	do.....	do.....	0.53	1.00	1.15	3.00	2.50		0.40	0.73	do.
9557	Fort Union, Dak.....	do.....	0.51	0.00	1.15	2.65	2.55		0.37	0.60	do.

TABLE XIX.—Measurements of eighty-one (and list of other) specimens of supposed *Hesperomys leucopus* SONORIENSIS from the Middle Region, United States—Continued.

Number.	Locality.	Collector.	Nose of—			Tail to end of—			Remarks.
			Eye.	Ear.	Occiput.	Tail.	Vert.	Hair.	
4911	Fort Union, Dak.	H. D. Schmidt							Alcoholic; young.
10122	do	do				3.80	2.10	2.30	Alcoholic.
10123	do	do				3.00	2.65	2.75	do.
2558	Upper Missouri.	F. V. Hayden							Alcoholic; young.
1997	North Platte River	W. S. Wood	0.45	0.75	1.00	2.40		0.35	Alcoholic.
1998	Medicine Bow River	do	0.50	1.65	1.00	2.60		0.35	do.
1932	Republican River	do	0.45	0.75	0.95	2.19	1.65		do.
1933	do	do							do.
3003	Fort Kearney	do				3.85	2.10		Dry.
3149	do	J. G. Cooper				3.00	1.90		do.
3134	Fort Laramie	do							Dry; young.
3138	do	do				3.30	2.40		Dry.
10419	do	do				3.25	2.50		
3053	Republican River	W. A. Hammond				3.10	2.50		Dry; leucopus.
3052	Pole Creek	do				4.00	2.30		Dry; stretched.
3920	Fort Randall.	J. P. McCown				3.50	2.75		Dry; leucopus.
6985	Fort Lyons, Colo.	E. Palmer							Dry.
9331	Nevada	R. Ridgway							Dry; young.
9737	Wyoming	H. D. Schmidt				3.10	2.90		Dry; leucopus.
9734	do	do				3.10	2.75		do.
9733	do	do				3.10	2.10		Dry.
9733	do	do				3.50	2.30		do.
7491	Pecos River, Tex.	J. Pope							Alcoholic; very young.
10116	do	do							do.
7449	do	do	0.44	0.82	1.00	2.80	2.90		Alcoholic.
7462	Quapaw Nation.	J. H. Clark				3.00	2.10		Alcoholic; leucopus?
7461	do	do	0.50	0.95		3.40	2.60	2.75	do.
10117	do	do	0.55	0.95	1.90	3.10	2.70	2.80	do.
7481	Upper Platte River	G. Suckley							Alcoholic; ungrown.
10119	do	do							do.
10120	do	do							do.
10121	Fort Benton, Mont.	J. G. Cooper							Alcoholic.
7764	do	do	0.47	0.85	1.00	2.90	2.95	1.40	do.
7475	Platte River	C. Drexler†				3.50	2.40		do.
4830	do	do	0.50	0.95	1.15	3.40	3.00	2.00	do.
10240	do	do							do.
10261	do	do							do.
9896	Fort Shaw, Mont.	L. B. Hitt				3.10	2.50	1.70	do.
10302	do	do							do.
10310	do	do							do.
7471	Fort Bridger	J. H. Simpson‡				3.00	2.75		do.
10311	do	do							do.
10312	do	do							do.
10313	do	do							do.
9889	Santa Fé, N. Mex.	Unknown				3.85	2.50		do.
7489	Fort Benton	Lieutenant Mullin							do.

† Drexler's extensive gatherings of mice, both from the Platte region and from Fort Bridger, are all essentially of the *sonoriensis* type. Those from the Platte, like Hayden's Nebraska and Upper Missouri lots, are very pale and short-tailed, while the Utah ones are rather more like *leucopus* in color, and the brevity of the tail is not quite so strongly marked. In both these series the specimens grade directly into *leucopus*. We have, however, labeled them all "var. *sonoriensis*" because the attempt to discriminate has proved utterly impossible in this as in other similar cases where we have been obliged to label geographically, so to speak. This gradation into ordinary *leucopus* is in strict accordance with, and amply confirms, our mature opinion respecting the "variety" *sonoriensis*.

‡ Colonel Simpson's examples, from Fort Bridger, are pure *sonoriensis*; so are Dr. Hitt's, from Fort Shaw.

We will next show that the short-tailedness of var. *sonoriensis* likewise characterizes, almost unexceptionally, the mice of Arctic North America. Indeed, this fact has already been shown in the previous table, which we introduced to settle the *myoides* question; these additional specimens, indeed, are merely the rest of our Arctic lot, positively the same as those of the "myoides" table. Most of these Arctic ones are noticeably larger than United States specimens, as was to have been expected; they average about 3.66 in length, with tail about 2.75; while the relative lengths of tail and body of *sonoriensis* are nearly repeated, about half an inch has been added to the absolute lengths of both trunk and tail. The feet are rather smaller, both absolutely and relatively, than in true *leucopus*, averaging only 0.75, notwithstanding the increase of general size. This feature, as well as the shortness of the tail, might be explained upon the well-known law of smallness of peripheral parts in Arctic animals; but it is curious that it should correspond exactly with the shortness of tail of the New Mexican animals, which, of course, are not amenable to this law. The tail and feet are both unusually hairy. Here is the table:—

TABLE XX.—Measurements of sixty-nine (and list of other) additional specimens of British American and Arctic HESPEROMYS LEUCOPUS, mostly of the "*sonoriensis*" type.

[Not much reliance can be placed on the dry measurements, as the skins are all badly prepared, being almost without exception overstuffed, the tails being skinned and distorted, and the feet having the toes curled up.]

Number.	Locality.	Collector.	Nose to—			Tail to end of—			Fore foot.	Hind foot.	Ear.	Remarks.
			Eye.	Ear.	Occiput.	Tail.	Vert.	Haize.				
5760	Fort Rae .....	L. Clarke, Jr. ....	.....	.....	.....	4.25	2.50	.....	.....	0.83	.....	Dry.
5770	do .....	do .....	.....	.....	.....	4.00	2.30	.....	.....	0.76	.....	do.
5780	do .....	do .....	.....	.....	.....	3.75	.....	.....	.....	0.73	.....	do.
5784	do .....	do .....	.....	.....	.....	4.00	2.25	.....	.....	0.71	.....	do.
5783	do .....	do .....	.....	.....	.....	3.75	2.40	.....	.....	0.79	.....	do.
5777	do .....	do .....	.....	.....	.....	4.25	2.40	.....	.....	0.80	.....	do.
5761	do .....	do .....	.....	.....	.....	3.90	2.25	.....	.....	0.79	.....	do.
5767	do .....	do .....	.....	.....	.....	4.50	2.00	.....	.....	0.78	.....	do.
5788	do .....	do .....	.....	.....	.....	4.10	2.00	.....	.....	0.83	.....	do.
5769	do .....	do .....	.....	.....	.....	3.50	2.30	.....	.....	0.78	.....	do.
5774	do .....	do .....	.....	.....	.....	3.50	2.40	.....	.....	0.77	.....	do.
5759	do .....	do .....	.....	.....	.....	4.10	2.30	.....	.....	0.75	.....	do.
5775	do .....	do .....	.....	.....	.....	3.75	2.00	.....	.....	0.79	.....	do.
5771	do .....	do .....	.....	.....	.....	3.60	.....	.....	.....	0.78	.....	do.
5763	do .....	do .....	.....	.....	.....	3.60	2.00	.....	.....	0.77	.....	do.
5779	do .....	do .....	.....	.....	.....	4.00	2.30	.....	.....	0.75	.....	do.
5764	do .....	do .....	.....	.....	.....	4.00	2.00	.....	.....	0.80	.....	do.
5776	do .....	do .....	.....	.....	.....	3.80	.....	.....	.....	0.78	.....	do.
5768	do .....	do .....	.....	.....	.....	4.00	2.00	.....	.....	0.78	.....	do.
5778	do .....	do .....	.....	.....	.....	3.75	2.40	.....	.....	0.77	.....	do.



TABLE XX.—Measurements of sixty-nine (and list of other) additional specimens of British American and Arctic *Hesperomys leucopus*, mostly of the "sonoriensis" type—Continued.

Number.	Locality.	Collector.	Nose to—				Tail to end of—		Fore foot.	Hind foot.	Ear.	Remarks.
			Eye.	Ear.	Occiput.	Tail.	Vert.	Hairst.				
3774	Fort Rae	L. Clarke, Jr.				3.50	2.10			0.70		Dry.
5741	do	do				3.50	2.30			0.75		do.
9448	Fort Simpson	W. W. Kirkby				4.50	2.80					do.
9447	do	do				4.00	3.00			0.90		do.
9430	do	do				3.50	2.75			0.80		do.
9446	do	do				4.00	2.00			0.70		do.
9449	do	do				3.50	2.10			0.70		do.
5183	Big Island, Great Slave Lake.	J. Reid				3.50	3.25					do.
5786	do	do				3.70	3.30					do.
7092	do	do				3.70	2.70			0.78		do.
5787	do	do				3.80	3.00					do.
5784	Fort Simpson	B. R. Ross				4.00	3.50			0.79		do.
5768	do	do				3.50				0.80		do.
4356	do	R. Kennicott										do.
4346	Fort Resolution	do										do.
8693	Sitka, Alaska	F. Bischoff				3.61	2.00			0.69		do.
3029	Nelson River	D. Gunn					2.60			0.70		do.
3029	do	do				3.25	2.30			0.73		do.
*6300	Lake Winnipeg	do				2.00	2.30			0.70		Alcoholic.
7437	Red River Settlement	do				3.45	2.30			0.73		do.
4553	do	R. Kennicott				3.00	2.20			0.70		do.
*9578	Liard River	W. Brass				3.00	3.00*			0.62		do.
*10091	do	do				2.00	2.50			0.60		do.
*10092	do	do				3.20	2.65			0.79		do.
4543	Fort Liard	A. Mackenzie										Dry.
4233	Moose Factory	C. Drexler				3.50	2.75			0.79		do.
7487	do	do										Alcoholic; very young.
7480	do	do										do.
*10093	do	do				3.40	3.00			0.68		Alcoholic.
*10094	do	do				3.00	2.85			0.78		do.
*10095	do	do				2.00	2.85			0.76		do.
7452	Fort Simpson	B. R. Ross				3.00	2.70			0.78		do.
7479	do	do				2.00	2.30			0.74		do.
9802	do	do				2.00	2.30			0.74		do.
10096	do	do	0.55	0.95	1.15	3.80	2.80	3.10	0.33	0.65		do.
10097	do	do	0.52	0.78	1.08	3.40	2.80	3.10	0.35	0.60	0.35	do.
10098	do	do	0.50	0.90	1.10	3.50	2.70	2.90	0.39	0.60	0.00	do.
10099	do	do	0.50	0.70	1.10	3.50	2.75	3.00	0.37	0.60	0.68	do.
10100	do	do	0.48	0.69	1.14	4.00	2.80	3.00	0.34	0.65	0.66	do.
10101	do	do	0.52	0.98	1.13	3.75	2.80	3.65	0.36	0.61	0.65	do.
10102	do	do	0.49	0.95	1.09	4.00	3.00	3.25	0.38	0.66	0.62	do.
10103	do	do	0.48	0.90	1.05	3.30	2.50	2.69	0.35	0.63	0.00	do.
10104	do	do	0.45	0.90	1.00	3.10	2.45	2.60	0.31	0.77	0.52	do.
10105	do	do	0.52	0.90	1.15	3.40	3.00		0.40	0.62	0.58	do.
9451	do	R. Kennicott	0.53	0.95	1.00	3.40	3.25					do.
7494	do	do				3.40	2.60	3.15				do.
7495	do	do				3.10	2.40	3.00				do.
7300	do	do										do.
7730	do	do				3.50	3.10	3.30				do.

\* In length of tail, these specimens depart from the rule for Arctic *Hesperomys*, and are true *leucopus*; but the tails and soles are very hairy, as usual, and the examples are probably best enumerated in this list.

TABLE XX.—Measurements of sixty-nine (and list of other) additional specimens of British American and Arctic HESPEROMYS LEUCOPUS, mostly of the "sonoriensis" style—Continued.

Number.	Locality.	Collector.	Nose to—				Tail to end of—		Fore foot.	Hind foot.	Ear.	Remarks.
			Eye.	Ear.	Occiput.	Tail.	Vert.	Hairs.				
7780	Fort Simpson .....	B. R. Ross .....	.....	.....	.....	3.35	9.80	3.00	.....	.....	.....	Alcoholic.
10111	.....do .....	.....do .....	.....	.....	.....	.....	.....	.....	0.78	.....	.....	.....do.
10112	.....do .....	.....do .....	.....	.....	.....	.....	.....	.....	0.77	.....	.....	.....do.
10113	.....do .....	.....do .....	.....	.....	.....	.....	.....	.....	0.80	.....	.....	Skins in alcohol
10114	.....do .....	.....do .....	.....	.....	.....	.....	.....	.....	0.79	.....	.....	.....do.
10115	.....do .....	.....do .....	.....	.....	.....	.....	.....	.....	0.78	.....	.....	.....do.
7501 to 7563	.....do .....	.....do .....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....do.

NOTE.—We have brought together our entire Arctic series of *H. leucopus* under the head of "sonoriensis", and nearly all our specimens will be found labeled "*H. leucopus* var." It is hardly necessary to add that, however, in this series every grade of approach to ordinary United States *leucopus* is found, and that a certain percentage of the specimens are identical with *Mammicossia* skins, for example.

Turning now to the matter of color, we find that certain differences in this respect have been ascribed to *sonoriensis* as diagnostic. This we can prove, first, to be so variable with specimens of "sonoriensis" *inter se* that it cannot distinguish them *inter alia*; and, secondly to be dependent upon local climatic influences. It fluctuates between wide extremes, and is assuredly unreliable, both on this account and because it is within the ordinary limits of color-variation of *leucopus* (see under "gambeli" and "austerus"). The intensity of coloration has precisely the same relation to hygrometric influences that Mr. Allen pointed out in the case of birds: the depth of color is in direct ratio to the mean annual rain-fall, or, in other words, to average humidity of the atmosphere. In dry, treeless regions, we have the palest forms; while the darker-tinted specimens occur in moist, wooded localities. This is precisely correspondent to the case of "gambeli" and "austerus", already noted. Some of our palest prairie specimens almost suggest albinism; most of the Nebraska series are remarkably pale, with an indistinct or almost inappreciable darker dorsal wash. Fort Crook specimens are darker than the average (just as the Fort Crook *Arvicolas* are), approaching *austerus* in this respect; Utah and New Mexican samples are intermediate. The narrowness of the dark stripe along the upper surface of the tail is simply of a part with the general pallor; so is the hoariness of the ears, which appears as a sort of silvery edging in most specimens. (*Cf. per contra* BAIRD, *op. cit.* 474.)

Recurring now to the Arctic series, we find that instead of being paler than average *leucopus*, they are almost without exception darker. In this

respect, they differ more from both *leucopus* and *sonoriensis* than these do from each other. They never gain either the rich "brown" of Massachusetts *leucopus* nor the silvery-gray or light fulvous of *sonoriensis*. They are nearer the house-mouse in color; the dark dorsal gray-brown washing over all the upper parts and the white below being far from snowy.

It is evident, then, that the coloration of these short-tailed mice of Interior and Arctic America cannot form part of a specific diagnosis.

Thus we have endeavored to show exactly what "*sonoriensis*" amounts to; and this done, it is a matter of indifference whether we retain the name or not. But, of course, after this exhibit, the animals bearing it cannot be considered specifically distinct from *leucopus*. Nor, in retaining the name, as we have judged it best to do, qualified by the sign "var.", can we look upon it as expressing a pure geographical race; for unquestionable *leucopus* occurs throughout the United States range of "*sonoriensis*", and everywhere the intergradation is perfect. In labeling our immense series, we shall hesitate to write "variety *sonoriensis*" on the placard of any but the shortest-tailed, palest, or grayest specimens.

Before leaving the subject, we will examine an interesting series of skins from Fort Cobb, which will point out our above remarks, and then notice some very instructive sets from Arizona, which pave the way for our discussion of *Hesperomys eremicus*.

TABLE XXI.—Measurements of twelve specimens of *HESPEROMYS* like *LEUCOPUS* from Fort Cobb.

Number.	Sex.	Date.	Locality.	Collector.	Head and body.	Tail.	Fore foot.	Hind foot.	Ear.	Remarks.
9351	♀	Mar. 14	Fort Cobb .....	E. Palmer .....	4.00	3.00	0.96	0.85	0.56	Dry; stretched.
9352	♀	Mar. 8	do .....	do .....	3.90	3.00	0.35	0.85	0.08	Dry.
9353	♂	Mar. 7	do .....	do .....	3.75	3.39	0.79	0.79	0.08	Dry; shrunken.
9354	♀	Mar. 9	do .....	do .....	3.00	2.70	0.60	0.58	0.08	Dry.
9355	♂	Mar. 7	do .....	do .....	3.00	2.70	0.60	0.58	0.08	Young.
9356	♂	Mar. 8	do .....	do .....	3.40	3.30	0.31	0.84	0.00	Dry; stretched.
9357	♂	Mar. 8	do .....	do .....	3.00	3.40	0.33	0.80	0.50	Dry.
9359	♀	Mar. 4	do .....	do .....	3.00	3.30	0.33	0.80	0.57	do.
9360	♂	Mar. 9	do .....	do .....	3.60	3.50	0.36	0.83	0.55	do.
9361	♀	Mar. 14	do .....	do .....	3.50	3.50	0.33	0.79	0.60	Dry; stretched.
9362	♂	Apr. 28	do .....	do .....	3.40	3.00	0.79	0.79	0.08	do.
9364	♂	Mar. 9	do .....	do .....	3.10	3.00	0.68	0.68	0.08	Dry.

This series is, perhaps, referable to *sonoriensis* on grounds of locality, but it is positively indistinguishable from ordinary *leucopus*. No. 9251, for example, is absolutely identical with an average Massachusetts skin. In

others, the tail seems to run a *little* shorter than an average, but not tangibly so, nor is it beyond extremes we have demonstrated for ordinary *leucopus*.

The following series is from the wooded mountainous region of Arizona:—

TABLE XXII.—Measurements of fourteen specimens of *HESPEROMYS*, apparently *SONORIENSIS*, from Northern Arizona.

Number.	Sex.	Date.	Locality.	Collector.	Head and body.	Tail.	Fore feet.	Hind feet.	Ears.	Remarks.
8443	♂	May 3, 1885	Fort Whipple, Ariz.	E. Cones	3.60	3.56	0.37	0.76	0.76	Dry; adult.
8450	♀	Mar. 30, 1885	do	do	3.75	3.25	0.38	0.75	0.65	do.
8441	♀	Feb. 3, 1885	do	do	3.90	2.75	0.38	0.75	0.65	do.
8440	♀	July 19, 1884	do	do	3.40	2.00	0.33	0.73	0.64	do.
8449	♂	May 11, 1885	do	do	3.00	2.25	0.38	0.72	0.64	do.
8449	♀	Jan. 28, 1885	do	do	3.00	2.30	0.35	0.74	0.71	do.
8460	♀	May 11, 1885	do	do	3.10	2.50	0.38	0.72	0.69	do.
8445	♂	Feb. 13, 1885	do	do	3.30	2.30	0.38	0.72	0.70	do.
8446	♂	Jan. 31, 1885	do	do	3.75	2.25	0.38	0.70	0.65	Dry; youngish.
8448	♂	Jan. 31, 1885	do	do	3.10	2.30	0.38	0.72	0.65	do.
8454	♂	Jan. 23, 1885	do	do	3.60	2.00	0.38	0.72	0.65	Dry; young.
8444	♂	Apr. 10, 1885	do	do	3.75	2.10	0.38	0.72	0.65	do.
8451	♂	Jan. 1, 1885	do	do	3.10	2.10	0.38	0.77	0.65	do.
8447	♂	May 24, 1885	do	do	3.50	2.00	0.38	0.72	0.65	do.
8452	♂	Mar. 30, 1885	do	do	3.00	2.00	0.38	0.72	0.65	Dry; very young.
8453	♂	Mar. 30, 1885	do	do	3.00	2.00	0.38	0.72	0.65	Dry; suckling of 8450.
8440	♀	Mar. 30, 1885	do	do	3.00	2.00	0.38	0.72	0.65	do.

This series\* was taken in the store-houses at Fort Whipple, where the mice had taken up their quarters, and seemed as thoroughly domesticated as ordinary house-mice. It unquestionably represents but a single species, readily referable to the variety *sonoriensis*, which we here have in all stages, from the suckling young to the adult. With the single exception below mentioned, there is nothing whatever of the *eremicus* stamp in the series. The soles are very furry indeed, owing, probably, to the fact that the animals were mostly taken in cold weather; the tails are well haired and bicolor, and noticeably short. In general coloration, these animals are darker than Palmer's desert examples, and, in fact, not distinguishable in this respect from ordinary *leucopus* of New England. But the ears seem to run a little larger than in Eastern United States examples; and they reach, in No. 8443, a size equal to that of *eremicus*. This same No. 8443 also differs from all the rest in having the tail barely shorter than the head and body, instead of upward of an inch shorter, and indistinctly bicolor. Its coloration leans toward that of *eremicus* in the pinkish-fulvous

\* It represents what we erroneously called "*Hesperomys eremicus*" in our article in the *American Naturalist*, 1, 396; but the name is probably correct as far as 8443 is concerned.

of the sides, &c.; and, on the whole, it is rather referable to this variety, although the soles are distinctly hairy. So that in this series, impossible to consider as representing more than one species, we find the form and coloration of true *leucopus*, of *sonoriensis*, and of *eremicus*. Stronger proof of the position we have taken up could not be desired.

We should remark that in some of these specimens, and various others from Arizona, there is a tendency, sometimes decided, to extension of the dusky on the base of the metatarsus, as in Mexican species.

TABLE XXIII.—Measurements of ten additional specimens of supposed *HESPEROMYS SONORIENSIS* from Southern Arizona.

Number.	Sex.	Date.	Locality.	Collector.	Head and body.	Tail.	Palm.	Sole.	Remarks.
8884	♂	Feb. 10, 1867	Camp Grant, Ariz. ....	E. Palmer .....	3.40	3.10	0.37	0.66	Dry; adult.
8872	♀	Apr. 18, 1867	.... do. ....	.... do. ....	3.50	2.95	0.34	0.78	.... do.
8883	♀	Feb. 10, 1867	.... do. ....	.... do. ....	3.70	2.30	0.31	0.75	Dry; youngish.
8885	♀	Feb. 10, 1867	.... do. ....	.... do. ....	3.00	2.95	0.31	0.78	.... do.
8886	....	Feb. 10, 1867	.... do. ....	.... do. ....	2.70	2.10	....	0.75	Dry; young.
8878	♂	Apr. 14, 1867	.... do. ....	.... do. ....	2.90	2.30	....	0.78	Dry; youngish.
....	....	....	.... do. ....	.... do. ....	2.10	2.50	....	0.75	.... do.
8887	♀	Apr. 18, 1867	.... do. ....	.... do. ....	3.40	2.50	....	0.76	.... do.
8879	♀	Mar. 10, 1867	.... do. ....	.... do. ....	2.70	2.40	....	0.75	.... do.
8874	♂	Apr. 14, 1867	.... do. ....	.... do. ....	2.10	....	....	0.70	Dry; adult.

The foregoing specimens were taken at Camp Grant, near Tucson, Ariz., at the same time as Dr. Palmer's examples of *eremicus* were collected, the two forms living side by side. As we say in another place, most of Dr. Palmer's specimens are true *eremicus*; but the above seem referable to the short-tailed, pale variety *sonoriensis*; the soles are all furred as in ordinary *leucopus*; the ears are short; and the distinctly bicolor, rather hairy, tail ranges much less than the head and body, while the nearly uniform pallor of the tints is much like that of prairie specimens. Only one, No. 8884, is more like true *leucopus* in its length of tail, exceptional in this series; while the shade of its coloration is almost exactly a in typical *eremicus*. No. 8874 is a precise duplicate of *H. gossypinus* in coloration.

### HESPEROMYS LEUCOPUS EREMICUS (Baird).

#### Desert Mouse.

*Hesperomys eremicus*, BAIRD, M. N. A. 1857, 479.—COUES, Quad. of Arizona, Am. Nat. 1, 338 (in part).  
*Hesperomys (Vesperimus) leucopus eremicus*, COUES, Proc. Acad. Nat. Sci. Phila. 1874, 180.

DIAGNOSIS.—*Hesp. leucopi* staturâ, caudâ elongatâ, truncum cum capite subæquante, sparse pilosâ, auriculis majusculis, subnudis, plantis palmisque

*nudis granulatis; supra flavido-grisea viz nigro limbata, lateribus flavicantioribus; subtus alba, caudâ obscure bicolore.*

Mouse about as large as *H. leucopus*, with rather longer and less hairy tail and ears, naked palms and soles, of a pale yellowish-gray above, thinly mixed with blackish hairs, more fulvous on the sides, the under parts white, the tail obscurely bicolor.

HABITAT.—Valley of the Gila and Colorado.

TABLE XXIV.—Measurements of six specimens of *HESPEROMYS LEUCOPUS EREMICUS*.

Number.	Locality.	Collector.	Nose to—				Tail vertebrae.	Fore foot.	Hind foot.	Ear.	Nature of specimen.
			Eye.	Ear.	Occiput.	Tail.					
1561	Fort Yuma, Cal .....	G. H. Thomas.....	.....	.....	1.08	3.17	4.08	.....	0.76	.....	Dry.
2574	.....do.....	.....do.....	0.48	0.53	1.07	2.77	3.70	0.30	0.80	0.60	Alcoholic.
2575	.....do.....	.....do.....	0.42	0.53	1.00	2.58	3.14	0.30	0.80	0.65	.....do.
1334	Colorado River.....	A. Schott.....	.....	.....	.....	3.60	3.60	.....	0.80	.....	Dry.
1335	.....do.....	.....do.....	.....	.....	.....	3.30	3.30	.....	0.73	.....	.....do.
1336	.....do.....	.....do.....	.....	.....	.....	3.50	3.50	.....	0.78	.....	.....do.

This highly interesting form of *Hesperomys* was based upon a few specimens from the Colorado Desert, and none but the original ones appear to have fallen under the notice of naturalists. In discussing its relationships to *leucopus*, its peculiar habitat in the midst of the Great American Desert, in the hottest region of the continent, must be kept prominently in view. Notwithstanding the remarkable characters in some respects that it offers at first sight, it will be found on closer examination to differ from *leucopus* solely in characters readily superinduced by the isolated physical conditions under which it lives. The ornithologist, in particular, is fully prepared to meet with the whole aspect of this case, from his knowledge of the modifications in color that the birds of the Colorado Desert afford, notably in such cases as those of *Harporhynchus*, *Pipilo*, &c. Nevertheless, the characters accurately given by Baird mark all the specimens as at least a highly specialized geographical race of *leucopus*.

The palest specimens of *Hesperomys* that we have hitherto inspected were from the comparatively dry and treeless regions of the Central Plateau; but these desert mice offer still more bleached coloration. The upper parts are of a pale fulvous-gray, obscured along the middle of the back by rather few blackish hairs. The sides fade insensibly into a pale brownish-yellow, or dull tawny cinnamon (almost with a pinkish wash), which reaches down the

fore legs to the hands. The under parts are pure white, as usual, with pretty distinct line of demarkation along the sides. The tail, along its dorsal aspect, is much paler than usual, agreeably with the general hue of the upper parts; but, on the contrary, it is so much darker than usual underneath that it appears nearly unicolor, and, at any rate, there is no definite line of separation of the two shades of color.

The soles of the feet present the extreme condition of nakedness as yet observed in any North American species of the genus. There is a light hairy fringe all along the sides; but at least a central median space, perfectly denuded, may be traced to the very heel. But this character, at first sight apparently so distinctive, is, as just intimated, merely the extreme of an insensible gradation from the dense hairiness of specimens from northern cold regions, and is strictly agreeable to a well-known law.

The ear will *average* a little longer than in *leucopus*, and corresponds with the feet in its scantier hairiness. The tail, likewise, is scant-haired, revealing the annuli very plainly. In length, this member will *average* considerably over the average of *leucopus*; but still it falls short of the extreme of the latter, as witnessed in Vermont "myoides" and Washington Territory "boylii"; and in the six specimens before us it varies in length about an inch; thus, it is, in No. 1581, nine-tenths of an inch longer than the head and body, and, in 1336, it is two-tenths of an inch shorter than the head and body.

Since the foregoing remarks upon *H. eremicus* were penned, we have handled an interesting and highly instructive series of skins from Camp Grant, sixty miles east of Tucson, Ariz., collected by Dr. Palmer. This series confirms our views by furnishing the stepping-stones before lacking, and proves that *eremicus* slides insensibly into the ordinary western form, of which it is, therefore, a geographical differentiation.

Of the twenty-two specimens in the series now lying before us, twelve are referable to *eremicus*; these are measured in the foregoing table. Of these twelve, eight or nine are pure typical *eremicus*, agreeing in having perfectly naked soles, very large, leafy, nearly naked ears, the scant-haired indistinctly bicolor tail about equal to the head and body (or, if anything, rather longer than shorter), and the coloration of the peculiar pinkish or ochrey-fulvous mixed on the back with quite black hairs; thus being identical with the original types of *eremicus*. The individual variations in these eight or nine specimens are quite as usual in any species or variety of the genus. In two

or three of the twelve, a slight hairiness of the soles, in varying degree, is evident, and the tail is noticeably shorter than the head and body; the ears, likewise, are not so large.

The rest of Dr. Palmer's specimens, ten in number, all taken in the same place and at the same time as the others—the two forms living side by side—are all distinctly referable to *sonoriensis*. They are elsewhere tabulated and commented upon.

TABLE XXIV.—Measurements of twelve additional specimens of *HESPEROMYS LEUCOPUS EREMICUS*.

Number.	Sex.	Date.	Locality.	Collector.	Head to root of tail.	Tail to end of hairs.	Fore feet.	Hind feet.	Ears.	Remarks.
8673	♂	Feb. 10, 1867	Camp Grant, Ariz. ....	E. Palmer. ....	3.10	3.30	0.33	0.70	0.67	Dry.
8675	♂	May 10, 1867	do. ....	do. ....	2.75	3.73	0.31	0.74	0.56	do.
8676	♂	Apr. 18, 1867	do. ....	do. ....	3.30	3.30	0.32	0.78	0.69	do.
8677	♂	Feb. 10, 1867	do. ....	do. ....	3.30	3.00	0.31	0.78	0.61	do.
8680	♂	Feb. 10, 1867	do. ....	do. ....	3.00	3.40	0.30	0.78	0.71	do.
8681	♂	Apr. 18, 1867	do. ....	do. ....	2.90	3.50	0.31	0.79	0.60	do.
8682	♀	Apr. 16, 1867	do. ....	do. ....	3.75	3.75	0.35	0.81	0.70	do.
8686	♂	Apr. 16, 1867	do. ....	do. ....	3.40	3.25	0.33	0.81	0.66	do.
8687	♂	—, 1867	do. ....	do. ....	3.50	3.60	0.31	0.80	0.73	do.
8689	♂	Mar. 10, 1867	do. ....	do. ....	3.25	3.50	0.32	0.80	0.67	do.
8690	♀	May 3, 1867	do. ....	do. ....	3.60	3.50	0.33	0.77	0.65	do.
8691	♀	Feb. 10, 1867	do. ....	do. ....	3.25	3.10	0.33	0.80	0.71	do.

### HESPEROMYS (VESPERIMUS) AUREOLUS, (Aud. & Bach.) Wag.

#### Red Mouse; Golden Mouse.

*Mus (Calomys) aureolus*, AUD. & BACH., Journ. Acad. Nat. Sci. Phila. vi, 1842, 302; Q. N. A. ii, 1851, 303, pl. 95.

*Hesperomys aureolus*, WAGNER, Wieg. Archiv, 1843, ii, 51.—ALLEN, Bull. Mus. Comp. Zool. ii, 1870, 180.

*Hesperomys (Vesperimus) aureolus*, COUES, Proc. Acad. Nat. Sci. Phila. 1874, 180.

† *Arvicola nuttalli*, HARLAN, Monthly Amer. Journ. 1833, 446; Med. & Phys. Res. 1835, 55, pl. —.

*Hesperomys nuttalli*, BAIRD, M. N. A. 1857, 467.

DIAGNOSIS.—*H. staturâ formâque Hesp. leucopi*; corpore suprà aureo-cinnamomeo, auriculis concoloribus, dorso medio obscuriore; infra luteo-albido.

Mouse like *leucopus* in size and shape, but very different in color, being golden-cinnamon above, and yellowish-white or pale buff below; ears agreeing with the general tint of the upper parts; middle back darker from admixture with blackish hairs; fore legs colored to the wrist; the dividing line between the color of the upper and under parts of the body and tail usually indistinct. Feet densely pilous above, and below the tubercles, which are large and crowded; toes rather short. "Mammæ, four; situated far back" (Aud. & Bach.).

HABITAT.—Central and Southern States.



The absolute size and relative proportions of this species will be illustrated by the following table of measurements, and require no further remark.

TABLE XXV.—Measurements of twelve specimens of *HESPEROMYS AUREOLUS*.

Number.	Sex.	Locality.	Collector.	Nose to—				Tail vert.	Fore foot.	Hind foot.	Ear.	Remarks and nature of specimen.
				Eye.	Ear.	Occiput.	Tail.					
1583	♂	Schuylkill River, Pa.	J. H. Richard	.....	.....	.....	3.13	2.93	.....	0.74	0.55	Dry; doubtful.
1584	♂	Society Hill, S. C.	M. A. Curtis	.....	.....	.....	3.30	2.75	.....	0.73	0.57	Dry.
1585	♂	do	do	.....	.....	.....	.....	.....	.....	.....	.....	do.
1586	♂	Charleston, S. C.	J. Morrow	.....	.....	.....	3.50	2.50	.....	0.74	0.54	do.
1587	♂	do	do	.....	.....	.....	3.40	2.50	.....	0.70	0.52	do.
4818	♂	Georgia	Dr. Geener	0.53	1.00	1.50	3.70	.....	0.38	0.70	0.57	Alcoholic.
4820	♂	Whitfield County, Ga.	A. Gerhardt	0.49	0.90	1.65	3.85	2.50	0.33	0.68	0.55	do.
4703	♂	Georgia	J. LeConte	.....	.....	.....	2.50	2.90	.....	0.70	.....	Dry.
1588	♂	Kemper County, Miss.	D. C. Lloyd	.....	.....	.....	2.30	2.70	.....	0.71	.....	do.
1589	♂	Knoxville, Tenn.	J. B. Mitchell	.....	.....	.....	1.17	2.83	2.75	.....	0.72	do.
2772	♂	do	do	0.52	0.88	1.30	1.00	2.00	0.40	0.75	0.63	Alcoholic.
2773	♂	Cairo, Ill.	R. Kennicott	.....	.....	.....	2.90	2.30	.....	0.65	.....	Dry.
1589	♀	Saint Louis, Mo.	G. Engelmann	.....	.....	.....	2.90	2.75	.....	0.70	.....	do.
1590	♀	do	do	.....	.....	.....	.....	.....	.....	.....	.....	do.
7451	♀	do	do	.....	.....	.....	.....	.....	.....	.....	.....	Alc., very young and doubtful.
10014	♀	do	do	.....	.....	.....	.....	.....	.....	.....	.....	do.

We are unable to appreciate any differences whatever in the series of skulls of this species as compared with a large number of those of *leucopus*.

This elegant species may usually be distinguished at a glance from *leucopus* by the peculiar and beautiful tint of the fur—a rich golden-cinnamon, a little darker from admixture of blackish hairs along the back; the ears like the general color, this extending on the fore legs to the paws, and a faint wash of the same tinting the under parts, between which and the upper parts the line of demarkation is usually obscure, and often, as in No. 1580, from Knoxville, Tenn., inappreciable. The brightest-colored samples of *leucopus* we have seen invariably lean to chestnut-fulvous, instead of the peculiar orange-fulvous of *aureolus*. The difference in the shade is hard to express in words, but it catches the eye at once. These brighter *leucopus*, moreover, have the ears dusky and the under parts snow-white, while in *aureolus* the orange tinges both these in a perceptible degree. The tail is but little paler below than above, with rarely, if ever, a line of demarkation.

While there is no question of the positive difference of this species from *leucopus*, even the small series before us shows considerable variation. In No.

4703, from the Southern States, probably Georgia, the under parts are not white at all, nor even whitish, but cinnamon, only a little paler than the sides. No. 981 has quite a black stripe along the back. No. 2964, from Illinois, is interesting in several respects. In the first place, the feet are remarkably small, less than in any *Hesperomys* we have seen, except *michiganensis*; and in some other respects, especially "*buccis flavis*", it corresponds better with Audubon and Bachman's description of *michiganensis* than the specimens we have referred to that species do. The under parts, moreover, are white. The general color of the upper parts, while showing unmistakable traces of the peculiar orange shade of *aureolus*, are much watered with a darker hue. This is another case of darker hue in Illinois rodents than elsewhere; for the *Arvicola riparius*, *Pitymys pinetorum*, and *Hesperomys leucopus*, all show this peculiarity. A Saint Louis, Mo., skin might be referable to this species with a shade of doubt, were it not accompanied by a little suckling one, possibly its offspring, which settles the case, and at the same time confirms the validity of the species in a very satisfactory way. This little creature is of the same bright orange-cinnamon as the adults, while, as is well known, the young of *leucopus* are, for some months, of a dark ashy-gray.

I only venture to include in this series a specimen (No. 548) from the Schuylkill River, Pa., with grave doubt. The animal appears to have been skinned out of alcohol, and the yellowish tinge of the under parts may be due to discoloration. In other respects, it is more like *leucopus* than *aureolus*, having dusky ears, sharp line of demarkation along the sides, &c.

Doubtless, after all, there are some who would prefer to consider *H. aureoleus* as a "permanent variety" of *leucopus*, but they need to be reminded that such course would remain simply a *petitio principii* until they explain the difference between a "permanent variety" and a "species".

The figure and description of *Arvicola nuttalli*, HARLAN, agree very well with the present species; but, as they represent a bright-colored *leucopus* quite as well, and contain nothing positively distinctive, I agree with Mr. Allen that it is not necessary to supersede the well-known and very expressive name *aureolus*.

## HESPEROMYS (VESPERIMUS) MICHIGANENSIS (A. &amp; B.) Wagn.

## Michigan Mouse.

*Mus michiganensis*, AUD. & BACH., Journ. Acad. Nat. Sci. Phila. viii, ii, 1842, 304; Q. N. A. iii, 1854, 336.

*Hesperomys michiganensis*, WAGNER, Wieg. Archiv, 1843, ii, 51.—BAIRD, M. N. A. 1857, 476.

*Hesperomys (Vesperimus) michiganensis*, COUES, Proc. Acad. Nat. Sci. Phila. 1874, 180.

*Mus bairdii*, HOY & KENNICOTT, U. S. Patent-Office Rep. Agric. for 1856 (1857), 92, pl. xi.

DIAGNOSIS.—*H. minimus*, (2½–3-poll.) *auriculis parvis, pedibus brevibus* (¾–¾ poll.), *caudâ truncum sine capite subæquante* (1¾–2-poll.); *supra cum pedibus subfulvescenti brunneus, plaga dorsali obscuriore; infra caudidus.*

Very small mouse, yellowish-brown above, with a broad dorsal stripe of sooty-brown, below pure white; feet not entirely white, as usual in *leucopus*; tail bicolor. Rarely 3 inches or more long; hind foot never exceeding 0.75, often much shorter; ears ½, or less, high; tail about equal to the trunk without the head.

HABITAT.—Upper Mississippi Valley; especially Illinois, Michigan, and Wisconsin. Kansas.

Without speculating upon the probable derivation by actual descent of this species from *H. leucopus*, we will rest upon the fact that here we have an animal positively distinct from *leucopus*. The differentiation from a common stock has proceeded so far that the connecting links, if any once existed, are broken or at least concealed. Out of a considerable number of specimens (see table below), there is not a single one that is not distinguishable on sight from *leucopus*. This, if not more remarkable, is, at any rate, the more interesting and instructive, since the true *leucopus* abundantly inhabits the regions where *michiganensis* occurs. As far as is known at present, *michiganensis* is one of the most restricted of our species in geographical distribution, being nearly confined to the valley of the Upper Mississippi. This, probably, is the reason why it adheres so faithfully to one particular style; and should it ever become dispersed over an area large enough to bring different individuals under decidedly different climatic and other influences, a divergence and variation would undoubtedly ensue. The only sign of such possible or probable differentiation at present is represented by what has been called *Mus "bairdii"* by Hoy and Kennicott. These excellent naturalists were unquestionably wrong in supposing a distinction of species here. Dr. Hoy expressed the whole thing in a nutshell when he wrote to Professor Baird:—"One thing is certain—we find one species in the oak openings, while the other is confined

to the prairie"; that is to say, the differences detailed by these authors are simply and exactly dependent upon whether the animal lives in woodland or in prairie.

As will be seen by the table below, *H. michiganensis* is much smaller than *leucopus*, averaging under three inches long (2.95), and only exceptionally, in extreme cases, reaching the average dimensions ( $3\frac{1}{4}$ ) of *leucopus*. Some adult examples, indeed, are hardly over  $2\frac{1}{2}$  in length. The next most conspicuous feature is the uniformly shorter tail, both relatively and absolutely. With an average of just two inches, it ranges from  $1\frac{3}{4}$ , or a little less, to  $2\frac{1}{4}$ , but is hardly ever over  $2\frac{1}{4}$ , and not very often below 2. In general, it about equals the head without the trunk, having, therefore, much the same relative strength as in *H. var. sonoriensis*. The smallness of the feet is equally marked and characteristic. The very largest hind feet do not exceed 0.75, which is below the average of *leucopus*; they range between 0.65 and 0.75, settling at 0.69 for the mean size. As it is rare for the smallest foot of *leucopus* to drop to 0.75, this feature alone gives indications by which probably nineteen specimens of every twenty could be identified. The ears are noticeably short and small every way; usually under 0.50 high, they run from 0.40 to 0.50, only very rarely surpassing the latter figure.

The coloration is almost equally distinctive in its uniform darkness. Most of the specimens come nearest to "austerus" in this respect. The dark color almost always\* extends on both feet to the digits, whereas in *leucopus* the feet are (usually) white. The shade is difficult to name, but may be called a mixture of gray and yellowish-brown on the sides, passing along the middle line of the body above, from nose to tail, as a broad stripe, into blackish-brown. The under parts are snow-white. The tail is always distinctly bicolor, and usually sharply so, but sometimes the under surface is brownish-white. The ears are blackish, usually without the slightest pale edging. The whiskers are light and dark, and the longer ones exceed the head.

This animal is stated to have six mammae—four abdominal and two pectoral. The label upon one of Mr. Kennicott's infant specimens says, "five found together." On the label of another of his, he states that "two old ones, with three young, were found in a rail-fence on the prairie."

Aside from the question of "bairdii", which must be summarily disposed

\* A Kansas specimen, which I refer to this species, forwarded for examination by Prof. F. H. Snow, presents the exceptional feature of nearly white feet; the dusky color of the legs only reaching a little way past the ankle, and not at all beyond the wrist.

of, there are no synonymical points to be determined in this case. There are, however, several discrepancies between the description of Audubon and Bachman and the characters of the animal which Hoy, Kennicott, Baird, and ourselves describe. Thus, they say, "mammaræ, six pectoral and four abdominal." We fail to realize "cheeks yellow," though, perhaps, they are a little brighter than surrounding parts. The dimensions given, 4 inches for length of head and body, are so much greater (by a full inch) that possibly the figure "4" may be a typographical error; but then the tail,  $2\frac{1}{2}$ , is nearly as much in excess of what we find. It is barely possible, after all, that, as Professor Baird hints, none of our specimens are what Audubon and Bachman called *michiganensis*. In that event, and if positively distinct from Audubon's and Bachman's animal, they would, of course, bear the name of "bairdii", and "michiganensis" Aud. & Bach. be relegated among the unnumbered synonyms of *leucopus*. But, in the seeming impossibility of determining this point, it is better to let *michiganensis* stand for what we now describe.

TABLE XXVI.—Measurements of forty-seven (and list of other) specimens of *HESPEROMYS MICHIGANENSIS*.

Number.	Sex.	Date.	Locality.	Collector.	Nose to—				Fore foot.	Hind foot.	Ear.	Remarks.
					Eye.	Ear.	Occiput.	Tail.				
*9950	...	...	Illinois .....	J. LeConte .....	...	...	...	3.70	1.90	...	0.65	Dry.
782	♂	...	Frémont, Ill .....	W. J. Shaw .....	...	...	...	3.00	1.9	...	0.67	...do.
783	...	...	do .....	do .....	...	...	...	...	...	...	...	Dry; young.
9951	♂	Apr. 2, 1855	Marion County, Ill ..	R. Kennicott .....	...	...	...	3.25	2.0	...	0.70	Dry; "Bairdii."
650	...	Apr. 15, 1855	West Northfield, Ill ..	do .....	...	...	...	2.00	...	...	0.71	Dry.
731	...	Sept. —, 1855	do .....	do .....	...	...	...	2.77	1.90	...	0.68	...do.
737	...	Apr. 23, 1855	do .....	do .....	...	...	...	...	...	...	...	Dry; very young.
738	♀	May 13, 1855	do .....	do .....	...	...	...	3.80	1.80	...	0.65	Dry.
739	...	May 13, 1855	do .....	do .....	...	...	...	...	...	...	...	...do.
977	...	May —, 1855	do .....	do .....	...	...	...	3.70	1.10	...	0.70	...do.
1406	...	Mar. —, 1856	do .....	do .....	...	...	...	3.00	2.00	...	0.70	...do.
9756	...	...	do .....	do .....	0.43	0.75	1.00	3.70	1.70	0.35	0.65	Alcoholic.
9757	♀	...	do .....	do .....	0.46	0.89	1.47	1.00	1.90	0.39	0.70	...do.
9758	♂	...	do .....	do .....	0.45	0.78	1.10	2.87	2.00	0.39	0.65	...do.
9759	...	...	do .....	do .....	0.50	0.69	1.10	3.30	2.25	0.35	0.70	...do.
9760	♂	...	do .....	do .....	0.50	0.83	1.05	2.95	2.35	0.39	0.71	...do.
9761	♂	...	do .....	do .....	0.46	0.86	1.05	2.85	2.30	0.39	0.66	...do.
9762	♂	...	do .....	do .....	0.50	0.85	1.05	3.25	2.35	0.35	0.77	...do.
9763	♀	...	do .....	do .....	0.58	0.67	1.05	1.47	2.55	0.36	0.70	...do.
9764	♂	...	do .....	do .....	0.45	0.75	0.54	1.90	1.67	0.30	0.65	...do.
9765	♂	...	do .....	do .....	0.51	0.67	1.10	3.30	2.30	0.35	0.75	...do.
9766	...	...	do .....	do .....	0.45	0.69	0.98	2.90	2.00	0.30	0.65	...do.
9771	♀	...	do .....	do .....	0.50	0.85	1.08	1.35	2.15	0.39	0.70	...do.
7435	...	...	do .....	do .....	0.48	0.78	1.08	2.80	1.75	0.31	0.60	...do.
9927	...	...	do .....	do .....	0.48	0.75	1.00	...	...	0.39	0.70	...do.
9929	...	...	do .....	do .....	0.47	0.79	1.00	2.75	1.75	0.34	0.75	...do.

\*9950; labeled "cognatus"!

TABLE XXVI.—Measurements of forty-seven specimens, &amp;c.—Continued.

Number.	Sex.	Date.	Locality.	Collector.	Nose to—			Tail.	Fore foot.	Hind foot.	Ear.	Remarks.
					Eye.	Ear.	Occiput.					
9929	..	.....	West Northfield, Ill.	R. Kennicott	0.50	0.85	1.04	2.70	1.75	0.33	0.66	Alcoholic.
9930	..	.....	do	do	0.49	0.71	1.05	2.60	1.60	0.34	0.68	do.
9931	..	.....	do	do	0.49	0.81	1.08	2.75	1.80	0.37	0.70	do.
9932	..	.....	do	do	..	..	..	2.59	1.75	..	0.69	do.
9933	..	.....	do	do	..	..	..	1.00	2.15	..	0.68	do.
9934	..	.....	do	do	..	..	..	1.00	1.85	..	0.70	do.
9935	..	.....	do	do	..	..	..	1.50	2.10	..	0.71	do.
9936	..	.....	do	do	..	..	..	3.16	2.00	..	0.69	do.
9937	..	.....	do	do	..	..	..	2.70	1.50	..	0.65	do.
9938	..	.....	do	do	..	..	..	3.61	1.70	..	0.70	do.
9939	..	.....	do	do	..	..	..	3.16	2.00	..	0.73	do.
9940	..	.....	do	do	..	..	..	1.00	2.20	..	0.72	do.
9941	..	.....	do	do	..	..	..	3.00	2.10	..	0.69	do.
9942	..	.....	do	do	..	..	..	5.00	1.50	..	0.68	do.
10463	..	.....	do	do	..	..	..	1.80	1.60	..	0.68	do.
10464	..	.....	do	do	..	..	..	..	..	..	..	do.
10465	..	.....	do	do	..	..	..	..	..	..	..	do.
10466	..	.....	do	do	..	..	..	..	..	..	..	do.
10472	..	.....	do	do	..	..	..	..	..	..	..	Alc., young.
10499	..	.....	do	do	..	..	..	..	..	..	..	Alcoholic.
10511	..	.....	do	do	..	..	..	..	..	..	..	Alcoholic.
9967	..	.....	Racine, Wis.	F. R. Hoy	0.49	0.80	1.00	3.15	3.30	0.34	0.74	do.
9968	..	.....	do	do	0.45	0.85	..	2.80	1.80	0.30	0.70	do.
9969	..	.....	do	do	0.44	0.85	..	..	0.30	0.65	0.45	do.
9767	..	.....	do	do	..	..	..	3.25	2.25	..	0.70	do.
9768	..	.....	do	do	..	..	..	3.00	1.90	..	0.70	do.
9769	..	.....	do	do	..	..	..	..	..	..	..	do.
9770	..	.....	do	do	..	..	..	..	..	..	..	do.
990	♀	.....	do	do	0.50	0.83	1.04	1.00	2.17	0.42	0.70	do.
990	..	.....	do	do	..	..	..	..	..	..	0.70	Dry.
990	..	.....	do	do	..	..	..	..	..	..	0.64	do.
990	..	.....	do	do	..	..	..	..	..	..	..	do.
10769	..	.....	do	do	..	..	..	..	..	..	..	do.
10777	..	.....	do	do	..	..	..	..	..	..	..	do.
10777	..	.....	West Northfield, Ill.	R. Kennicott	..	..	..	..	..	..	..	Alcoholic.
10777	..	.....	Neosho Falls, Kans.	N. S. Gos.	..	..	..	..	..	..	..	Dry.

## HESPEROMYS CALIFORNICUS, (Gambel) Baird.

## Parasitic Mouse.

*Mus californicus*, GAMBEL, Proc. Acad. Nat. Sci. Phila. iv, 1848, 78 (Monterey).  
*Hesperomys californicus*, BAIRD, M. N. A. 1857, 478 (Santa Clara County, Cal.).  
*Hesperomys* (*Vesperimus*) *californicus*, COUES, Proc. Acad. Nat. Sci. Phila. 1874, 180.  
*Hesperomys parasiticus*, COOPER, MSS.—BAIRD, op. cit. 479 (in text).

DIAGNOSIS.—*H. crassitie dimidium muris decumanâs subæquans, caudâ longissimâ subnudâ vix bicolore, pedibus uncialibus plantis nudis, auriculis maximis sparsissimè pilosis; supra fuscus, lateribus sensim flavicantibus, infra albidus.*

Nearly as large as a half-grown house-rat, with extremely long nearly naked ears and tail, the latter scarcely bicolor; feet an inch long, with naked soles; dark grayish-brown above, becoming pale cinnamon-brown on the sides, the under parts whitish.

HABITAT.—Southern and Lower California.

Our few specimens, mostly the same as those described by Baird in 1857, indicate a species perfectly distinct from *leucopus*. The animal looks, in fact, much like a partly-grown *Neotoma*; it is quite as large as some examples of *Oryzomys palustris*, while its long and sparsely hairy tail, no less than its size, gives it somewhat the aspect of a young Norway rat. No one of the interminable variations of *leucopus* have so far shown us anything like this.

The size and proportions of the species are illustrated in the table given below. It may be said to be four or five inches in length of trunk, with the tail about the same—half an inch longer or as much shorter than the head and body. The feet are an inch or a little more long, and share with *eremicus* the peculiarity of naked soles, although the very extremity of the heel is not perfectly denuded. The immense ears are a striking feature, measuring three-fourths of an inch or more in height by about two-thirds of an inch in width. They are very closely pilous on both sides, as will be seen by close inspection, but appear at first sight quite naked. The little hairs are so short that they do not form any perceptible fringe. The shape of the ear is also remarkable; instead of being evenly rounded, it is like the two sides of a rectangle with the upper corner rounded off. The tail is scant-haired, showing the annuli plainly.

The pelage is remarkable for its softness, fullness, and gloss, although it is not long, measuring less than half an inch on the back. It is very different

from average *leucopus* in its sootiness, being, in fact, perhaps darker than *leucopus* ever becomes, unless in the "gossypinus" variety; and here the shade is different, being of a leaden grayish-brown, mixed with a good deal of black, yet watered throughout with fulvous. The color reaches to the wrist and ankle, but the upper surfaces of the hands and feet are whitish. On the sides, the color shades into a pale tawny-cinnamon or brownish-fulvous, very nearly of the same tint as in *eremicus*. The under parts can hardly be called white, owing to a suffusion of leaden-gray showing through the white tips of the hairs. The tail, as already stated, is dark, and not much paler below than above, with a very indistinct—sometimes inappreciable—dividing line. The ears show blackish in the dried state; probably dusky flesh-color in life. The very long whiskers, many of which reach to the shoulder, are partly black and partly white.

Among the Fort Tejon specimens (*Xantus*), we find two examples of *californicus* instantly distinguishable from the numbers of "gambeli" with which they are associated, and typically representing *californicus*. Several Tejon "gambeli", indeed, show a tendency toward *californicus* in their large size and length of ears and tail, but nothing quite up to this remarkable form. Besides the dimensions tabulated below, No. 7478 shows these measurements: Nose to eye, 0.55; to ear, 1.02; breadth of ear, 0.70; pencil of hairs at end of tail, 0.30; whiskers, 1.75. The soles, which have the ordinary six tubercles, are almost entirely naked; the ear is sparsely and delicately pilous. The hand and feet are white above; the tail is indistinctly bicolor, brown above, whitish below; it is nearly *five inches* long, with the terminal pencil about 5.25, which, the body being only 3.60, is the longest tail, both relatively and absolutely, we have seen in a United States *Hesperomys*.

TABLE XXVII.—Measurements of four specimens of *HESPEROMYS CALIFORNICUS*.

Number.	Sex.	Date.	Locality.	Collector.	Head.	Head and body.	Tail vert.	Fore foot.	Hint foot.	Ear.	Nature of specimen.
1156	♂	Nov. —, 1855	Santa Clara, Cal.	J. G. Cooper	1.35 1.25	4.00 4.50	4.80	0.54	1.05	0.75	Dry.
1157	♀	Nov. —, 1855	do	do	4.50	4.50	4.00	.....	1.00	0.70	Fresh.
3670	♂	.....	Fort Tejon, Cal.	J. Xantus	4.00	4.50	4.50	.....	0.90	0.90	Dry.
7478	♂	.....	do	do	1.30	3.00	4.90	0.45	1.00	0.85	Alcoholic.

The different *H. californicus* aside, all the California *Hesperomys* we have seen are referable to "gambeli", excepting the Fort Crook series, which



rather fall under the *sonoriensis* category by reason of the shortness of the tail. There is little to note regarding these specimens. No. 7186, from Fort Mojave, is about the palest fulvous all over the upper parts we have seen, but still is not at all like *eremicus*. No. 7183 is almost a typical *leucopus*. The two adults of the Tejon series have almost exactly the body-colors of *gossypinus*; and we should not omit to note that they have a suspicious sort of resemblance to *H. californicus*. Nor should we be surprised if some mice from this vicinity should be found to bridge over the chasm that now appears between the *leucopus* styles and the seemingly very different "californicus"; one, at least, of the Tejon specimens (No. 3670) being veritable *californicus*. We have already noted that Northern Californian mice, and more particularly Oregon and Washington ones, are darker than those of Southern California (in this respect precisely matching Massachusetts *leucopus*), and that they shade directly into *austerus* in this respect, as well as in the length of the tail.

#### HESPEROMYS (VESPERIMUS) AZTECUS, De Saussure.

##### Astec Mouse.

*Hesperomys aztecus*, DE SAUSSURE, R. M. Z. 1860, 105, pl. ix, f. 4 (teeth).

*Hesperomys (Vesperimus) aztecus*, COUES, Proc. Acad. Nat. Sci. Phila. 1874, 180.

DIAGNOSIS.—*H. leucopus* staturâ par, et formâ similimus, sed caudâ subnuda et coloribus differt. Brunneus, dorso nigricante, lateribus ferrugineis, partibus inferioribus albis; antebrachio extus lateribus concolore, crure et parte tertia basali metatarsi fuscescentibus; caudâ fere unicolore.

HABITAT.—"Mexico" (De Saussure).

This species belongs strictly to the *Hesperomys leucopus* group,\* and does not differ noticeably in size or proportions from that species. The coloration, however, appears specifically distinctive; it differs from that of the ordinary United States species precisely as *Neotoma ferruginea* differs from *floridana*.

The upper parts are rich rusty-red, almost orange rust-color, on the back deepening into a broad area of brownish-black, and only showing in its intensity on the sides where the line of demarkation with the white of the under parts is distinct and sharp. The head shares somewhat of the general blackening of the middle area above, but is not so uniformly dark as the back; the extreme muzzle is dark, leaving about the mouth only the sides of the

\* In all external features, at any rate; but we have not ascertained the existence of cheek-pouches.

lips to share the white of under parts; the latter is not quite pure, owing to the showing through of the gray bases of the hairs. On the fore leg, the color of the sides, or a darker shade, extends to the very wrist, there stopping abruptly, leaving the surface of the paw white (or light). On the outside of the crus, the color of the sides, or a deeper shade, extends to the tarsus, and thence on the basal third of the metatarsus; forming a sharply-defined blackish area, as in *H. sumichrasti*, &c. This is a strong feature that never occurs in true *leucopus*; the rich rusty-red of the sides is likewise an entirely peculiar shade so far as United States mice are concerned, though common to several Mexican species. The ears are dusky in the present state of our specimen; the tail, of which less than two inches remains on the specimen, is very obscurely paler below and nearly as naked as in *Mus*; but this last feature may not be permanent.

The foregoing is the adult coloration. We have no information whether the young are like the adult, or plain gray like young *leucopus*.

Length, about 3.75 inches (0<sup>mm</sup>.095, De S.); tail, averaging over 4.00; hind foot, 0.90; fore foot, 0.38; ear, about 0.62 high from notch in front.

Described from one of the three original specimens, No. 3926, Museum of the Smithsonian Institution, received from M. De Saussure, and labeled in what is apparently his handwriting.

M. De Saussure's label bears the suggestive query, "*H. texanus*?" There is no reasonable doubt that the animal is a subtropical offset of *H. leucopus*, modified just as *Neotoma ferruginea* has been; but, at the same time, the differentiation has proceeded so far that we are bound to place the animal on specific footing, at any rate until intermediate specimens are forthcoming.

Since writing the foregoing, we find, as stated in another place, a number of alcoholic specimens, undoubtedly referable to this species, among a lot of *leucopus (gambeli)* from Cape Saint Lucas. The fact that these examples are instantly distinguishable strengthens the probabilities of the permanent distinctness of *aztecus* from any of the United States varieties of *leucopus*. They all show a nearly naked and almost unicolor tail, and the peculiar extension of the dark color on the base of the metatarsus. A suckling young appears to be gray, like young *leucopus*, as was to have been anticipated. We cannot make out, in the alcohol, whether or not the peculiar richness of the ferrugineous, with very black dorsal area, exists or not, the wet specimens being indistinguishable in body-colors from the "*gambeli*" that came

with them. The following table gives detailed measurements, and we are now enabled for the first time to state the length of the tail, which exceeds that of the head and body very decidedly, sometimes nearly one and a half inches.

TABLE XXVIII.—Measurements of six specimens of *HESPEROMYS AZECUS*.

Number.	Locality.	From tip of nose to—				Tail to end of—		Length of—		Height of ear.	Nature of specimen and remarks.
		Eye.	Ear.	Occiput.	Tail.	Vertebra.	Hairs.	Fore foot.	Hind foot.		
3096	Mexico .....				3.75			0.38	0.90	0.63	Dry; type.
10335	Cape Saint Lucas .....	0.46	0.98	1.15	3.10	4.40	4.50	0.35	0.83	0.68	Alcoholic.
10336	do .....	0.50	0.90	1.15	3.20	4.15	4.25	0.34	0.80	0.70	do.
10337	do .....	0.43	0.88	1.10	3.00	4.10	4.15	0.33	0.77	0.64	do.
10338	do .....	0.48	0.90	1.10	2.80	3.70	3.75	0.33	0.79	0.62	do.
10339	do .....				2.30	2.90				0.62	Alcoholic; ungrown.
10330	do .....										Alcoholic; suckling.

### HESPEROMYS (VESPERIMUS) MELANOPHRYS, Coues.

#### Black-eyed Mouse.

? *Hesperomys mexicanus*, DE SAUSSURE, R. M. Z. 1860, 103, pl. ix, f. 1, 1a.\*

*Hesperomys (Vesperimus) melanophrys*, COUES, Proc. Acad. Nat. Sci. Phila. 1874, 181.

(No. 10183.) With the general aspect of a large species of the *Hesperomys leucopus* group. Tail a little longer than the head and body together, slender,

\* "Velutinus, griseus, murinus; in lateribus paulum fulvescens, frequenter subferrugineus; subtus albidus, pectore et mento fulvescentibus; pedes antici albi; auriculæ permagnæ; cauda corpore longior; mystaces elongati.

"Intermediate in size between *M. musculus* and *M. rattus*. Pelage soft and velvety. Head conic, lengthened; lip cleft to the nose; muzzle hairy except the septum. Ears very large and broad, but higher than wide, rounded, but with the upper margin a little angular. Tail long, nearly equal to the head and body together, but sometimes only exceeding the body alone. Feet ('pattes'—more likely meaning limbs here) very long, especially the hinder, the animal standing high. Color, dark brownish mouse-gray ('gris de souris brun-noirâtre'), with a slight silvery shade on the back, the very tips of the hairs being yellowish-gray; head not quite so dark; cheeks rusty-gray; the yellowish always stronger on the flanks. Feet, externally yellowish-gray (gris-fauve). Lips and chin pale yellowish-gray, and entire under parts grayish-white, apparently plumbeous, because the slaty roots of the hairs show through; the white distinctly separated from the color of the flanks. Breast and front of the shoulder washed with yellow. Fore feet white, or grayish; the hinder brown, with the ends of the toes white. Ears apparently naked, but covered with short close hairs. Tail scaly, slightly hairy, black above, white below. Whiskers blackish, very long, reaching to or beyond the shoulders.

"Some individuals are yellower than as above; the sides becoming ferrugineous, strongly marked on the flanks at the line of separation between itself, the white of the belly here becoming almost pale orange. Sides and under surface of the head, as well as the shoulder and breast, strongly washed with rusty-yellow. In other specimens, on the contrary, the rusty color is not very evident.

"Length of one specimen, about  $4\frac{1}{2}$ , with tail  $4\frac{1}{2}$ ; of another, about 4, with tail  $3\frac{1}{2}$ ; hind foot slightly over one inch."

The foregoing is M. De Saussure's diagnosis, with an abridged translation of his further description; the chief points of discrepancy, as compared with our specimens of *melanophrys*, being italicized. It is inserted for convenience of comparison.

rather scant-haired. Absolute and relative proportions of both fore and hind feet and their digits as in *leucopus*; soles moderately hairy on the posterior third. Ears large and leafy, appearing naked, but, with a hand-lens, may be seen covered with short, sparse, close-pressed hairs. Whiskers reaching to or beyond the shoulder. Skull strictly as in *Hesperomys leucopus* (the palate ending opposite the last molars, not far behind them, as in *Mus*, *Oryzomys*, &c.), but less thin and papery, and developing a slight bead on the superior margin of the orbit, as in the larger mice generally; this may be traced nearly to the occiput.

Color above giving the general impression of a uniform *gray* mouse, rather than a red mouse with darker median dorsal area, like *leucopus* or *aztecus*. It is a gray, enlivened with fulvous suffusion, slightly darker along the back, more decidedly fulvous on the sides, and everywhere with a peculiar slight glaucous or hoary suffusion. On the head, the gray shows noticeably purer, and the *eyes seem encircled with a black ring, in marked contrast*, the edges of the eyelids and a small antecular space being jet-black. This is strong enough to suggest and warrant the specific name above imposed; I have seen nothing like it in any other species.

Color below pure white, but the plumbeous roots of the hair show through, giving a grayish cast. Line of demarkation everywhere abrupt between the white and the color of the upper parts. The outside of the fore leg is colored to the very wrist, but the top of the hand is white. On the hind leg, likewise, the color runs to the tarsus *and a little beyond*, forming a definite dark spot at the base of the metatarsus; the remaining five-sixths of the surface of the foot is pure white. Tail above like the back, below gray—not pure white, nor the line of demarkation very sharp, though evident. Ears an undefinable color in the dried state, showing simply flesh-colored, probably, in life. No yellowish nor fulvous tinge on the chin, breast, or any other under parts.

Length four inches, or a little more. *Tail four and a half to five inches.* Hind foot one inch, a slight fraction more or less. Ear, measured from the notch in front, about four-fifths of an inch. Nose to eye, 0.62; to ear, 1.12.

HABITAT—Southern Mexico (Tehuacan; Santa Efigenia, Tehuantepec, *Sumichrast*).

The great difficulty of recognizing from descriptions the smaller mice that show no striking peculiarities of form is well known, and must be our

apology in this instance if *melanophrys* turns out to be simply *mexicanus*. At first, we referred our specimens to the latter with little hesitation; but, on reviewing the subject, they show so many differences from M. De Saussure's description that we cannot effect an identification. In general dimensions, the two species, if such they are, seem nearly the same; but in *mexicanus*, the tail is only longer than the body alone, never even equaling the head and body together; while in all our specimens the tail is considerably longer than the head and body. This, however, taken alone, we should not consider a specific difference, after our experience with *Hesperomys* "myoides" and "boylii"; but there are other differences. De Saussure speaks of grayish-white under parts, with yellowish on the chin and breast; but in these specimens the whole under parts are as uniformly pure white as in *leucopus*. He says the hind feet are brown; in our animal, they are pure white, with a definite dusky area at the base of the metatarsus. The tail in his animal is described as white below; in ours, the bicoloration is not so evident as this would imply. Finally, he makes no mention of the singularly conspicuous black ring around the eye. All things considered, it is most probable that De Saussure had in view an entirely different animal.

The skull, as already stated, is extremely similar to that of *Hesperomys leucopus*, the species thus falling legitimately in the restricted group, of which *leucopus* is typical. The chief difference is the presence of a distinct bead on the margin of the orbits, traceable nearly to the occiput. This, however, we cannot consider as even subgeneric; for, as elsewhere stated, it is only the smallest and most delicate *Hesperomys* that are entirely devoid of this crest, which makes its appearance with a very slight increase in the general size and vigor of any species. The dentition shows nothing peculiar. The palate, as in *H. leucopus*, ends as a simple transverse shelf opposite the last molar—a feature by which, as well as by its general slenderness, elongation of rostrum, &c., it is distinguished from that of *Oryzomys*; the latter agreeing in the development of a slight orbital bead. Skull No. 3344 measures 1.20 in length by 0.64 in breadth, thus obviously exceeding that of *leucopus*. The coronoid process appears extremely short and slight, merely a little spiculum; the bullæ ossæ are noticeably small.

Two female specimens show two pairs of inguinal mammæ and one axillary pair. A note of Professor Sumichrast's, accompanying one of these, gives the following particulars:—"Nov. 30, 1862. Found among the leaves

of a maguey, in a nest built of fibres of 'zaiate', containing two little ones."

This animal, compared with the somewhat smaller and the brighter-colored *aztecus*, bears much the same relations that the large gray *californicus* bears to the *leucopus* ("gambeli"), with which it is associated in California.

TABLE XXIX.—Measurements of three (dry) individuals of *H. MELANOPHYRUS* (= ? *MEXICANUS*, DeS.) from Southern Mexico.

Number.	Locality.	Collector.	Nose to—				Tail.	Fore foot.	Hind foot.	Ear.
			Eye.	Ear.	Occiput.	Tail.				
10183	Santa Efigenia . . . . .	F. Sumichrast . . . . .	0.62	1.12	1.40	4.15	5.00	0.42	1.04	0.78
10296	Tehuacan . . . . .	.....do . . . . .			1.30	4.00	4.80	0.40	1.06	0.81
9511	Tehuantepec . . . . .	.....do . . . . .				3.90	4.90	0.40	0.99	0.77

NOTE.—Since writing the preceding, we have examined three other specimens from Tehuantepec, which, if the same as the types of *melanophrys*, lessen the chances that the latter is different from *mexicanus*. But they differ in many respects from the specimens just enumerated, being so very much smaller that we cannot satisfy ourselves of their identity. The tail only exceeds the body in one specimen, and here only by little; in the others, it is about as long, relatively, as De Saussure gives for *mexicanus*. That these specimens are not immature is shown by the fact that one of them is a nursing female. In color, they are almost precisely like the foregoing, but do not show the black ring round the eye, nor the dusky spot at base of the metatarsus. One of them is pure white below; another is grayish (it looks as if soiled); while the third has the faintest possible fulvous tinge all along the under parts.

Much more material than that now in our possession will be required to determine the limits of variation of this large, gray, *leucopus*-like mouse of Mexico, and fix the species upon secure basis.

TABLE XXX.—Measurements of three dried specimens, probably of *MELANOPHYRUS*, *Coues* (= ? *MEXICANUS*, DeS.), but much smaller.

Number.	Locality.	Collector.	Length.	Tail.	Foot.
9382	Barrio, Tehuantepec . . . . .	F. Sumichrast . . . . .	3.50	3.20	0.67
9389	.....do . . . . .	.....do . . . . .	3.20	3.00	0.70
9383	.....do . . . . .	.....do . . . . .	2.90	3.10	0.69

### SUBGENUS ONYCHOMYS, Baird.

*Hypudaeus* sp. MAXIMILIAN, Reise, etc. ii, 1841, 99 (nec auct.).

*Mus* sp. AUD. & BACH., Q. N. A. ii, 1861, 327.

*Onychomys*, BAIRD, M. N. A. 1857, 458 (type, *Hypudaeus leucogaster*, MAX.).—COUES, Proc. Acad. Nat. Sci. Phila. 1874, 182.

CHARS.—Skull strictly as in *Hesperomys*, but molars larger, with sharper salient and reëntrant angles. External form departing from *Hesperomys*, and

approaching *Arvicola* in stoutness, and especially in shortness of tail and ears. Tail not one-half the length of the body alone, little if any longer than the head, very stout, tapering to an obtuse point. Ears small—about as in *Evotomys*—rounded, pilous both sides. Fore feet very large, two-thirds to one-half as long as the hind, with large, little curved, fossorial claws, longer than those of the hind feet; the latter at most two-thirds as long as the tail. Soles quadrituberculate only, densely furry to the tubercles. Fur short, close, white beneath, as in *Hesperomys*.

The remarkable mouse upon which the section was based is worthy of subgeneric separation, at least, from the *Hesperomys* group of which *leucopus* is typical. In its peculiar combination of characters, it stands quite alone among North American species. Although unmistakably a true Murine, as shown by the cranial and other fundamental characters, it nevertheless deviates much from *Mus* and *Hesperomys*, and approaches the Arvicolines. Its affinities with *Evotomys* are really close; and it is through this genus that the way for it into *Arvicola* proper is opened. In external form, indeed—the stoutness of body, shortness of ears, and especially the shortness of tail—it resembles *Evotomys rutilus*, for example, more than it does *Hesperomys leucopus*; while, at the same time, of its real affinity with the latter there can be no question. An interesting parallel can be drawn between *Onychomys* as compared with *Hesperomys*, and *Synaptomys* as compared with *Myoides*. *Onychomys* has the skull and dentition of *Hesperomys* in a body externally resembling *Evotomys*, while *Synaptomys* has the skull and dentition of *Myoides* in a body externally resembling *Evotomys*.\* *Onychomys* offers another interesting parallel. In the subgenus *Pitymys* as compared with *Arvicola* proper, three external characters are shortness of tail, shortness of ears, and length of fore feet and claws; and therefore *Onychomys* stands in much the same relation to *Hesperomys* that *Pitymys* does to *Arvicola*. These analogies are to us extremely interesting; and the habits of *Onychomys leucogaster*, when fully known, will doubtless be found to offer some peculiarities corresponding to the structural features.

We are unable to point to any perfectly diagnostic characters of the skull of this section as compared with that of *Hesperomys*. In size it about equals the larger examples of *H. leucopus*; it appears, however, somewhat narrower behind, with less interorbital constriction, and broader and more

\* See further under head of *Evotomys* considered as a synthetic form.

obtuse rostrum. The margins of the orbits are not beaded as in *Oryzomys*. The descending process of the lower jaw is, perhaps, not quite so flat and quadrate, being a trifle more bent and angular, slightly foreshadowing the hamular process of *Arvicolinæ*; and, likewise, the coronoid is longer, rising high above the condyle. To our view, the molars present unmistakably a slight deviation from *Hesperomys* toward *Arvicolinæ* in being somewhat prismatic; that is, with sharp salient and reëntrant angles; the borders of the molar series being serrate, rather than crenate as in *Hesperomys*. Nevertheless, no generic dental characters of *Hesperomys* are here violated.

On casually picking up a specimen of *Onychomys leucogaster*, one might be forgiven for supposing the tail to be broken off—this member is so short and "stumpy". The base is very thick, and the tapering to an obtuse point is rapid. The tail is well clothed with hairs, as usual; but these only furnish an apology for a terminal pencil. Both the absolute and relative length of the tail is shown in the table below. The large fore feet, armed with remarkably long and little curved claws, point to fossorial powers, and possibly to subterranean habits, not shared by any other *Hesperomys*. Next in importance, after the relative sizes of the fore and hind members (which latter are unusually short), must be ranked the peculiar condition of the soles, in which the two posterior of the six tubercles usually seen both in *Hesperomys* and in *Arvicola* have disappeared, or at least cannot be detected beneath the fur that densely covers the metatarsus, leaving only four tubercles at the bases of the toes. The middle finger is the longest of all; the fourth next; the first is rudimentary; the fifth is between the second and first; the second between the fifth and fourth. The inner toe is very short; the outer intermediate between this and the other three, which are all of about the same length. The ears, as we have said, are, in the type of the subgenus, much smaller than in *Hesperomys* proper, and very much as in *Evotomys*; they are closely pilous both sides.

The fur is very compact and lustrous, with few long hairs; the whiskers are numerous and very long; the eyes are larger than in *Arvicolines*, but have not the size and prominence of those of the true Murines. The upper lip is cleft to the nasal papillæ, and the entire muffle, except these protuberances, is hairy. The bicolor pattern of coloration is exactly as in *Vesperinus*.

This section is based upon the *Hypudæus leucogaster* of Maximilian, afterward the *Mus missouriensis* of Audubon and Bachman. To the original type-



species we have had the pleasure of adding a new and interesting variety, if not species, from a hitherto unsuspected locality. The following are the comparative diagnoses of the two forms:—

Beneath, snow-white; above, mouse-brown, with darker dorsal area. Tail twice the hind foot or less; much less than half the head and body. Fore foot more than half the hind foot. Ear about 0.50 high. . . . . LEUCOGASTER.

Beneath, tawny-white;\* above, brownish-fulvous, with no darker dorsal area. Tail about  $\frac{1}{2}$  and a half times the hind foot; almost half as long as the head and body. Fore foot half the hind foot. Ear about 0.75 high. . . . (var.?) TORRIDUS

### HESPEROMYS (ONYCHOMYS) LEUCOGASTER (Maxim.).

#### Missouri Mole-Mouse.

*Hypudæus leucogaster*, MAXIMILIAN, Reise in das Innere N.-Amer. II, 1841, 90 (Fort Clark).

*Hesperomys (Onychomys) leucogaster*, BAIRD, M. N. A. 1857, 480 (Nebraska).—COUES, Proc. Acad. Nat. Sci. Phila. 1874, 182.

*Hesperomys leucogaster*, MAXIMILIAN, Arch. Naturg. xviii, 1862, pl. 4, f. 8; Verz. N.-A. Säug. 1862, 161, fig. *Mus missouriensis*, AUD. & BACH., Q. N. A. II, 1851, 327, pl. 100 (Fort Union).

HABITAT.—Upper Missouri region. Red River of the North (Coues).

Our notice of the subgenus *Onychomys* has necessarily involved the details of its type-species so largely that but little remains to be added. The absolute dimensions and relative proportions of several specimens, most of them additional to any heretofore published, are fully elucidated in the following table.

In color, the animal closely resembles *Hesperomys leucopus*—so closely that it is difficult to describe any differences. When young, it is of the same plumbeous-gray above and ashy-white beneath; and, with advancing age, these colors change to snowy-white below and fulvous-brown above, with a dusky dorsal area. The feet are white; the tail is bicolor; the whiskers are black, with a few white ones intermixed. The chief distinguishing feature in coloration, as compared with *Hesperomys leucopus*, is the mostly white muzzle. In *leucopus*, the white usually slopes down to the lips, leaving the nose of the color of the forehead; while, in *leucogaster*, the white keeps on, and embraces the snout. This curious difference holds good in all the speci-

\* As intimated beyond, we are not perfectly sure that the yellowish tint is not due to discoloration in alcohol.

mens before us, and we do not doubt its constancy. It is well shown in Audubon's left-hand figure.

One young specimen (No. 3092) from the Medicine Bow Mountains, in the gray pelage, is remarkably pale-colored above, the tail nearly white, &c. This corresponds exactly with the pale *Hesperomys* var. *sonoriensis* and the pale *Arvicola* of the *Pedomys* section, from the same region.

The only skull before us (No.  $\frac{19881}{9880}$ ) offers the following measurements:—Length, 1.07; interorbital width, 0.20 (the zygomata are destroyed); width across cranium, 0.48; lower jaw, from tips of incisors to condyle, 0.72; length of upper molar series, 0.19.

TABLE XXX.—Measurements of nine specimens of HESPEROMYS (ONYCHOMYS) LEUCOGASTER.

Number.	Sex.	Date.	Locality.	Collector.	Nose to—							Remarks.
					Eye.	Ear.	Occiput.	Tail.	Tail.	Fore foot.	Hind foot.	
1980	—	—, 1855	Near Missouri River .....	F. V. Hayden .....	.....	.....	.....	4.00	1.40	.....	0.88	Dry.
9849	.....	.....	.....do.....	.....do.....	0.60	1.07	1.35	4.00	1.40	0.29	0.45	Alcoholic.
7499	.....	.....	Runningwater .....	.....do.....	0.60	1.00	1.28	4.25	1.65	0.50	0.88	do.
4607	♀	.....	Fort Riley, Kans. ....	H. Brandt .....	.....	.....	.....	3.50	1.30	0.40	0.70	Not grown.
3091	♂	July 23, 1857	Medicine Bow Mountains ..	W. S. Wood .....	.....	.....	.....	3.50	1.30	0.40	0.70	do.
3092	♂	Sept. 10, 1857	Republican River, Kans. Ter	.....do.....	.....	.....	.....	4.50	1.60	0.44	0.87	Stretched.
3378	♂	.....	Neesho Falls, Kans. Ter ....	B. F. Goss .....	0.61	1.05	1.30	4.50	1.50	0.45	0.83	Dry.
3783	♂	.....do.....	.....do.....	.....do.....	0.56	1.00	1.15	4.25	1.50	0.50	0.83	do.
3794	♂	.....do.....	.....do.....	.....do.....	0.58	1.00	1.15	4.40	1.40	0.53	0.88	do.

\* Other measurements of 2349, given by Baird, are:—Fore arm, 0.59; longest finger and claw, 0.54; its claw alone, 0.30; femur, 0.55; tibia, 1.03; longest toe and claw, 0.30; its claw alone, 0.14.

## HESPEROMYS (ONYCHOMYS) TORRIDUS, Coues.

## Arizona Mole-Mouse.

*Hesperomys (Onychomys) torridus*, COUES, Proc. Acad. Nat. Sci. Phila. 1874, 183.

DIAGNOSIS.—*O. imaginem* *O. leucogastri* referens, sed caudā longiore, auriculis præcipuè majoribus, plantis minus pilosis, unguibus manūs debilioribus, et coloribus magis flavescens, primo visu differt; murino-fulvus; rostro toto, pedibus, partibusque omnibus inferioribus flavo-albis; caudā lined fuscā angustatā nec ad apicem porrectā suprā notatā. Long. 3½, caudæ 2, manūs ½, pedis ½, auriculæ ferè ½.

HABITAT.—Arizona.

(No. 9886, ♀).—On comparing this animal with typical *leucogaster* from Kansas and Nebraska, the differences in general form are obvious. Truly *Onychomys*, with the unmistakable aspect of that section, yet the members are

larger. This is particularly noticeable in the ears. The small arvicola-like ears of *O. leucogaster* are among its striking external features; in *torridus*, the ears are fully as long as in ordinary *Hesperomys*, measuring nearly three-fourths of an inch long by about half an inch wide. The ears are delicately pilous, with fluffy tuft at base; basally, the membrane is flesh-colored, otherwise it is dusky, with a delicate silvery margin. The fore feet have the claws noticeably smaller than in average *leucogaster*, but this is a very variable feature in the latter species. It is probably owing to this shortness of the claws that in *torridus* the hands are only half as long as the soles; in *leucogaster*, they are almost invariably more than this; sometimes upward of two-thirds as long. The hind feet are pilous underneath to the toes, showing only four tubercles, as in *leucogaster*, but the hairiness is not so dense. The tail, like the ears, is much longer than in *leucogaster*. In the latter, it ordinarily ranges from  $1\frac{1}{3}$  to  $1\frac{2}{3}$  of an inch in length, sometimes scarcely exceeding the length of the head, and being usually less than twice the hind foot. In *torridus*, the tail is at least half the head and body together, and noticeably more than twice as long as the hind foot. These various discrepancies in form are, in fact, so prominent that we have been obliged to remodel in some respects the diagnosis of the subgenus, as we originally drew it up from consideration of *leucogaster* alone.

The colors\* are highly characteristic. The snowy-white of the whole under parts and feet of *leucogaster* is replaced by a yellowish-white, or an extremely pale buff or fawn. The dark stripe along the top of the tail is very narrow, and falls considerably short of the tip, which is wholly whitish. The whole muzzle is whitish, as in *leucogaster*; the fluffy hairs about the ears give rise to a pale patch in front of each, which, with the dusky body of the ear and its silvery edging, produce a parti-coloration not seen in *leucogaster*. The entire upper parts are of a warm though rather light brownish-fulvous, entirely different from the gray mouse-brown which *leucogaster* usually exhibits, and, moreover, without appreciable darker dorsal area. The line of demarkation along the sides is abrupt, as in *leucogaster*.

The animal is apparently somewhat smaller than an average *leucogaster*, but not much so, and not less than some specimens of the latter. No. 9886 measures, nose to eye, 0.50; to ear, 0.95; to occiput, 1.25; to root of tail

\* Our type has been skinned out of alcohol; still, we are not sure that the fluid has appreciably affected the coloration, for specimens of *leucogaster* which have lain in spirits a much longer time are not changed perceptibly.

(perhaps a *little* stretched), 3.75; tail to end of vertebræ, 1.90; to end of hairs, 2.00; fore foot, 0.40; hind foot, 0.80; ear 0.70 high, 0.40 wide. Camp Grant, Arizona. The specimen is a female, apparently having recently bred, showing four well-developed inguinal teats; pectoral mammæ, if existing, have eluded our search, and were certainly not functionally developed in this case.

As already intimated, this single specimen is differentiated from *leucogaster* according to extensively applicable laws of geographical variation; for which reason we suspect that intermediate examples will eventually be found, showing it to be merely an offset from *leucogaster*. But if any links exist, they remain unknown.

#### SUBGENUS ORYZOMYS, Baird.

< *Mus* sp. HARLAN, Am. Journ. Sci. 1837

< *Hesperomys* sp. WAGNER, Suppl. Schreb. 1843.

× *Arvicola* sp. AUD. & BACH., Q. N. A. iii, 1853.

= *Oryzomys*, BAIRD, M. N. A. 1857, 458; type, *Mus palustris*, HARL.

COUES, Proc. Acad. Nat. Sci. Phila. 1874, 183.

CHARS.—Superior margin of orbit with a prominent sharp edge or bead. Anteorbital foramen nearly circular above (somewhat as in *Zapodidae*), continued below as a slit much narrower than in *Hesperomys* proper. Maxillary plate forming outer wall of the foramen not produced anteriorly into a pointed process (cf. *Sigmodon*). Posterior border of palate produced behind last molars, a deep pit intervening on either side; post-palatal notch narrow, with parallel sides, and nearly straight, transverse, anterior border. Hind legs short, but feet very long and large (much as in *Fiber*), with obliquely-set long toes; densely pilous above, but soles perfectly naked, granular, with one long, narrow, postero-internal tubercle (as in *Mus*) and five small ones. Lateral toes very unequal in length, the fifth reaching to the penultimate joint of the fourth (cf. *Sigmodon*); all the toes have a slight but evident basal webbing. Fore feet small, not half as long as the hinder, pilous above; palms perfect'y naked. Ears small, little overtopping the fur, hirsute both sides, with a fluffy tuft on the concavity. Nasal pads more noticeable than in other sections. Tail long, about equaling head and body, scant-haired, especially above where the dermal scales as well as the vertebral annuli are visible. Fur glossy, but coarse from the number of bristly hairs. Whiskers sparse and short, exceed-

ing, however, those of *Sigmodon*, though falling short of those of *Hesperomys* proper. Exceeding in size any other known North American species of *Hesperomys*, and with the general appearance of *Sigmodon* or even *Mus*.

Further details of this interesting section, the most conspicuous among North American *Hesperomys*, and almost worthy of generic rank, will be found under the head of its typical and only known species, the common "Rice-field Mouse" of the Southern States. While it does not require for its identification any comparison with its allies, we may here note the position it holds among them, after a description of the skull.

*Skull* (Nos. 1111, 1112, from South Carolina).—The size of the skull alone distinguishes it from that of any other North American *Hesperomys*, except, perhaps, *H. californicus*, measuring nearly an inch and a quarter in length by nearly two-thirds of an inch in zygomatic breadth. It has, however, other interesting peculiarities. Prominent among them is the sharp ridge or bead into which the superior edge of the orbit is produced. However sharp the border of the orbit may be in the smaller *Hesperomys*, it does not form this bead, which seems to characterize chiefly larger forms, as we find it in *Mus decumanus*, *Sigmodon hispidus*, &c. The anteorbital foramen tends to assume a rather unusual shape for a Sigmodont, being subcircular above, and running into a narrow slit below; the feature, however, is not very strongly marked, and may vary, moreover, with different individuals. We have seen skulls of *Mus decumanus* in much the same condition. As in *Mus*, *Sigmodon*, and *Hesperomys* proper, the incisive palatine foramina are long, reaching to or even beyond a point opposite the anterior molars; the opposite is shown in *Neotoma*, where the foramina fall far short of the molar series. The great backward production of the bony palate that *Oryzomys* shows does not occur in any other North American *Hesperomys* (where the posterior edge of the palate is about opposite the last molar), and perhaps represents one extreme in this respect, of which *Neotoma*, where the palate is scooped out to opposite the middle molar, may be the other extreme. The little deep pit, or fossa, on either side of the palate opposite the last molar, is as in *Sigmodon*; but in the latter these pits are separated by a median lengthwise process, which is not the case in *Oryzomys*, where the hind border of the bony palate is almost perfectly straight crosswise. This backward extension of the palate in *Oryzomys* is almost exactly the same as in *Mus (decumanus)*; and, altogether, the cranial characters, saving the Sigmodont dentition, are certainly the nearest to those of typical *Mus* of any *Hesperomys* of North America, if indeed they

are not actually more like *Mus* than they are like *Hesperomys*. This cranial resemblance to Old World Murines is strikingly borne out by the external characters of the animal, which, in general appearance, looks really more like a small house-rat than like one of our New World *Hesperomys*. The resemblance is at a climax in the very long, scant-haired tail, on which not only are the annuli distinct, but the granular plates perfectly evident, at least along the upper side of the tail. The aquatic nature of the animal is indicated by the feet and ears. The former are much like those of *Fiber* in being naked and granular beneath, velvety-pilous above, and especially in having such long toes, slightly webbed at base and set obliquely on the metatarsus, to facilitate their "feathering" during their forward motion in swimming. The low, orbicular, thickly hirsute ears are specially provided with a fluffy tuft inside to guard against entrance of water, and the antitragus is well developed for the same purpose. While the general construction of the feet is much as in *Fiber*, the tuberculation of the soles is like that of *Mus*.

On the whole, we may consider this animal as (next after *Onychomys leucogaster*, which leans so strongly toward *Arvicola* through *Evotomys*) the most aberrant of the North American group of small *Hesperomys*, sharing many features of the larger *Sigmodon*, showing a slight approach, by analogy at least, to *Fiber*, and having much real affinity with the Old World *Mus* proper. It is certainly the nearest to typical *Mus* of anything we have in North America; it inclines toward *Mus* proper, and especially to *Sigmodon*,\* much as *Onychomys*, our only other subtypical section of *Hesperomys*, does toward *Arvicola*.

#### HESPEROMYS (ORYZOMYS) PALUSTRIS, (Harl.) Wegner.

##### Rice-field Mouse.

*Mus palustris*, HARLAN, Am. Journ. Sci. xxxi, 1837, 386 (New Jersey).

*Hesperomys palustris*, WAGNER, Suppl. Schreb. iii, 1843, 543.—LECONTE, Proc. Acad. Nat. Sci. Phila. vi, 1853, 410.—ALLEN, Bull. Mus. Comp. Zool. ii, 1870, 182 (Florida).

*Hesperomys (Oryzomys) palustris*, BAIRD, M. N. A. 1857, 422 (Georgia and South Carolina).—COUES, Proc. Acad. Nat. Sci. Phila. 1874, 184.

*Arvicola oryzivora*, AUD. & BACH., Q. N. A. iii, 1853, 214, pl. 144, fig. 3.

**HABITAT.**—South Atlantic and Gulf States, especially in maritime portions and in rice-fields. Kansas! (*Goss*). Mexico (*Sumichrast*). Jamaica!!

The specific characters of this animal are necessarily involved with

\* We have already noted how close is the relation between *Oryzomys* and *Sigmodon*, showing that the former is as much to be considered a section of *Sigmodon* as of *Hesperomys*, and that *Sigmodon* itself is hardly or not more different from ordinary *Hesperomys* than *Oryzomys* is.

those of the subgenus of which it is the type and only representative, and probably most of them have already been mentioned in our account of *Oryzomys*. The animal varies a great deal in size, from the dimensions of a third-grown house-rat up to the size of a small individual of that species; and these larger ones really look so much like *Mus decumanus* that one might almost be excused for making the mistake. The tail, as usual, varies still more than the body in length. The body and tail average, perhaps, about equal to each other in length; the former ranges usually from about four to five and a half inches in length. In the largest specimen before me, No. 3327, from Neosho Falls, Kans., the total length of trunk and tail together is  $10\frac{1}{2}$  inches; figures far above any reached by any other North American *Hesperomys* (the largest *H. californicus* falls short of  $9\frac{1}{2}$  in the same measurement). The general range of variation is much the same as in other *Hesperomys*. This, with the absolute size and relative proportion of parts, is so fully illustrated in the table below that further notice here is unnecessary.

The pelage of this animal is rather coarse, if not harsh, but it is glossy from the great proportion of long, glossy, soft bristles that it has. Perhaps the most interesting point in this connection is the unequal hairiness of the upper and under surfaces of the tail. On top, this member is so scantily hirsute that the pavement of granular reticulations is distinctly visible; below, the plates are *generally* hidden by longer and more numerous hairs. The difference is most evident in those tails that are distinctly bicolor. There is a great range of variation in this latter regard; some tails being almost as sharply bicolor as in *H. leucopus*, while others are merely a little paler below than above. In this case, as in others throughout the genus, we have often thought that the difference is not so much an individual matter as one dependent upon *season*, age, and state of health; and that the same individual may change in this respect. Like *H. aureolus (nuttalli)*, this animal does not show the sharp dividing line along the sides between the colors of back and belly; the two generally blend insensibly. The darker color always reaches down the limbs to the ankle and wrist, and involves the extremity of the snout, although the lips and cheeks are like the belly. The color is a mixture of yellowish-brown, grayish-brown, and black, producing the grizzly rat-color impossible to name. The mixture is very intimate; only the lighter shades prevail over the sides and ramp, and the darker along the dorsal area, sometimes producing a pretty distinct stripe, but oftener shading insensibly into the general hue. The under parts are whitish, of varying purity, but rarely

quite pure; generally, it is obscured by the ashy of the roots of the hairs showing through, and it often has a faint brownish wash, like a very weak dilution of the color of the sides. The ears have no distinctive coloration. The eye is usually surrounded by a slight blackish area, which sometimes, as in No. 1305, extends as a frenum to the muzzle, there meeting its fellow. The moderately abundant whiskers, of medium length, are some of them black, others colorless.

The palms and soles are both perfectly naked; on top, these members are clothed to the nails with short close-pressed hairs of satiny texture and luster, sometimes pure glossy-white, at others soiled; this furring is generally dense, but sometimes so scanty that the flesh-color of the skin shows through. Sometimes the palms and soles are flesh-colored, sometimes they are blackish. The soles are 6-tuberculate: (1) a long linear tubercle along the inner side, midway between toe and heel; (2) a very minute one just outside the anterior end of the last; (3, 4) one at base of both inner and outer toe; and (5, 6) two at bases of the three central toes. Where non-tuberculate, most of the sole is granular-reticulate; all the toes are annular-scaled transversely underneath, with a terminal node. The 2d, 3d, and 4th toes are very long, and almost of equal length; the 5th reaches nearly to the middle of the 4th; the 1st scarcely beyond the base of the 2d. The claws are all short, thick, little curved, and not very sharp; the calcaneal tuberosity is prominent; traces of the several metatarsals are evident. The largeness of the foot itself is in striking contrast with the shortness of the hind leg. There are five tubercles on the palms, almost entirely occupying the surface; two very large ones posteriorly, subequal in size and side by side, in fact almost coalescing; the inner of these bears the little nodule, capped by a bit of horn that represents the pollex. There is another smaller tubercle at the base of the 2d and 5th fingers respectively; and a fifth at the conjoined base of the 3d and 4th fingers. The 3d finger is longest, the 4th but little shorter; the 2d and 5th successively diminish rapidly.

Unlike the feet, the ears are not densely and softly pilous as in other *Hesperomys*, but are hirsute—almost strigous—with rather long and stiffish straight hairs, that form a slight fringe. A part of these, nearest the antitragus, on the concavity of the auricle, are longer than the rest, and form the tuft already mentioned. The back of the ear is pretty evenly furred, though rather more scantily toward its base than around the edge. The ears project a little beyond the general fur.



This remarkable rat has hitherto only been reported from the Southern Atlantic seaboard, where it is said to be abundant, particularly in the rice districts. It is eminently aquatic; in this respect equaling the *Arvicola amphibius* of Europe, and, in our country, only surpassed by the muskrat. Its whole structure, but particularly its feet and ears, point to its amphibious nature. Several specimens in the present collection, from unsuspected localities, enable us to greatly extend its known range. Several were taken in Kansas by Mr. B. F. Goss, who also forwarded from the same locality in that State (Neosho Falls) examples of *Onychomys leucogaster*, *Pedomys austerus*, *Synaptomys cooperi*, and other interesting animals. These Kansas specimens of *Oryzomys* are larger than Carolina or Georgia ones, and otherwise a little different in having heavier tails, lighter colors, &c.; but do not raise a suspicion of specific distinction.\*

The original *Mus palustris* of Harlan purports to be from New Jersey; and, as there is no reasonable doubt of this, it is the northernmost recorded locality. There is little to be said of the bibliography of the species; in fact, the "General Remarks" in Audubon and Bachman, which are here reproduced to settle the question of *Mus palustris*, Harlan, comprise everything essential. "We obtained," they say (*op. cit.* 216), "specimens of *Arvicola oryzivora* in the winter of 1816, but did not describe it until May 1836. . . . Having occasion to send descriptions of several, then undescribed, species to the Academy of Natural Sciences of Philadelphia, we sent a specimen of this animal to Dr. PICKERING, requesting him and Dr. Harlan to compare it with the *Arvicola riparius* of ORD. . . . In searching in the Academy, a specimen of this species was found, and Dr. HARLAN, in opposition to the views of PICKERING, felt himself authorized to publish it in SILLIMAN'S American

\* A specimen, No. 9436, from Tuxtitan, Tehuantepec (Professor Sumichrasi), I cannot distinguish from the ordinary *palustris* of Carolina. It is about 4.25 long; tail, 4.50; foot, 1.30. In color, it is a little clearer than most Carolina skins, yet not of the paler yellowish-brown noticed in Kansas ones, but rather a brighter fulvous-brown; the under parts are unusually pure white. I have not met with any Mexican quotations of *Oryzomys*; but if any species has been described from Mexico, and of which No. 9436 is an example, it cannot well prove different from *palustris*. The case seems to me to be parallel with that of the *Sigmodon*s elsewhere discussed.

Two Jamaican skins of *Oryzomys* (Nos. 7775 and 8117), received since the preceding was written, agree completely with *palustris* in size and shape, but are noticeably different in color. They are of a rich ferrugineous-brown, only a little darker along the back, and the under parts are strongly washed with a dilution of the same. The difference, indeed, from the ordinary dark Carolina *palustris*, is nearly as evident as in some of the dullest *Hesperomys aureolus* compared with *leucopus*. Probably these specimens represent a race if not a good species; but, in my ignorance of the physico-geographical influences that work upon the West Indian rats, I cannot pursue the subject, and especially refrain from giving any name to the animal, as I presume it has been described, though I have not met with any reference to it.

Journal (vol. xxxi), bestowing on it the name of *Mus palustris*, making use of the head of our specimen for an examination of the teeth."

Thus it appears that Harlan's species was based, in part at least, upon the very same specimen that afterward became the type of *Arvicola oryzivora*, Aud. & Bach. The latter authors, naturally disliking Harlan's pre-emption of their species, re-appropriated it to themselves in this wise:—"They took it for an *Arvicola*, and reasoned that "as the name '*Arvicola palustris*' is preoccupied (HARLAN,\* FAUNA, p. 136) we are favored with an opportunity \* \* of restoring it to its true genus under the name [*oryzivora*] given by its legitimate describer." How such excellent naturalists as Audubon and Bachman could have been betrayed into such a blunder as to consider *Oryzomys* an *Arvicola*, we cannot imagine; but they were just as wide of the mark when they placed *Hesperomys sonoriensis*, LeC., and "campestris", LeC., and "texana", Woodh., all under *Arvicola*; and when they described the Texan *Sigmodon* as *Arvicola texiana*. To be sure, it was vexatious that Harlan should have anticipated them in such a summary way; but for this often-recurring accident there is no help that we can see; and, at any rate, the genus *Arvicola* proved an inconveniently small loop-hole in this case.

TABLE XXXI.—Measurements of twenty specimens of *HESPEROMYS PALUSTRIS*.

Number.	Sex.	Locality.	Collector.	Nose to—				Tail vertebrae.	Fore feet.	Hind feet.	Ear.	Nature.	
				Eye.	Ear.	Occiput.	Tail.						
1454	...	Society Hill, S. C. ....	M. A. Curtis .....	.....	.....	.....	4.00	4.50	0.50	1.18	0.54	Dry.	
1455	♂	do .....	do .....	.....	1.33	3.75	3.60	0.48	1.17	0.58	...	do.	
1947	...	do .....	do .....	.....	.....	.....	4.00	3.80	0.59	1.17	0.50	...	do.
1948	...	do .....	do .....	.....	.....	.....	4.50	4.80	0.53	1.15	0.53	...	do.
2003	...	do .....	do .....	0.54	1.19	1.30	4.10	4.05	0.45	1.10	0.59	Alcoholic.	do.
2004	...	do .....	do .....	0.70	1.10	1.35	4.25	4.05	0.50	1.15	0.58	...	do.
2005	...	do .....	do .....	0.58	1.00	1.25	.....	3.75	0.43	1.06	0.45	...	do.
2006	...	Saint Simon's Island, Ga. .	E. W. Wilson .....	0.53	0.94	1.25	3.70	3.60	0.42	1.11	0.58	...	do.
2010	...	do .....	do .....	0.60	1.10	1.35	3.80	4.50	0.50	1.19	0.50	...	do.
2011	♂	do .....	do .....	0.90	1.35	4.00	4.30	0.48	1.13	0.55	...	do.	
2019	♀	do .....	do .....	0.53	1.00	1.25	4.00	3.90	0.44	1.05	0.50	...	do.
2709	♂	do .....	do .....	0.51	0.90	1.20	3.80	3.65	0.45	1.01	0.45	...	do.
2748	...	do .....	do .....	.....	.....	.....	.....	.....	.....	.....	.....	...	do.
2710	...	Tehuantepec, Mexico .....	J. P. Postell .....	0.60	1.12	1.30	3.75	4.25	0.50	1.15	0.55	...	do.
2711	...	do .....	do .....	.....	.....	.....	3.80	4.10	0.50	1.10	0.51	...	do.
2806	♂	Columbus, Ga. ....	Dr. Gessner .....	0.61	1.12	1.40	4.35	3.70	0.52	1.16	...	...	do.
2807	♀	do .....	do .....	0.63	1.19	1.60	4.65	3.90	0.50	1.14	0.52	...	do.
2701	♂	Neosho Falls, Kans. Ter. .	R. F. Goss .....	.....	.....	.....	4.25	4.50	0.40	1.06	0.46	Dry.	do.
2708	...	do .....	do .....	.....	.....	.....	4.75	4.00	0.50	1.10	...	...	do.
2709	...	do .....	do .....	.....	.....	.....	5.50	5.00	0.57	1.20	...	...	do.
2827	...	do .....	do .....	.....	.....	.....	.....	.....	.....	.....	.....	...	do.
2436	...	Tehuantepec, Mexico .....	F. Sumichrast .....	.....	.....	.....	4.25	4.50	.....	1.20	.....	...	do.

\* This number is complemented by suckling young from Nos. 2908 to 10512, inclusive.

\* Harlan's *Arvicola palustris* is = *A. riparius*, Ord.

NOTE.—As preliminary to consideration of the genus *Ochetodon*, a notice of the South American *Reithrodon* is introduced, to facilitate comparison between the two.

### GENUS REITHRODON, Waterhouse.

*Reithrodon*, WATERHOUSE, Proc. Zool. Soc. 1837, 29; Zool. Voy. Beagle, pt. II, 1839 (see LeConte, Baird).

DIAGNOSIS.—Upper incisors sulcate. Rostral portion of the skull large in proportion to the cranial, producing a high convex forehead; zygomatic width of skull about two-thirds its length; interorbital portion narrow; posterior nares contracted from close approximation of the pterygoids; palate with lateral paired fossæ, and ending nearly opposite or beyond the last molar; incisive foramina very long, extending to or beyond the first molar; coronoid process small and reflected; condyloid narrow and very oblique; descending process large, subquadrate, the emargination between this and the condyle deep. Size large; form stout and compact; head broad and arched; eyes large and prominent. Ears moderate, pilous. Soles hairy behind; lateral toes subequal and extremely short. Tail short, about one-half the head and body, moderately hairy.

Notwithstanding this genus has certain peculiarities of external form that combine to produce an aspect unusual among Murines, it is certainly a true member of the subfamily, as Waterhouse originally pointed out, and agrees with *Murina* in every essential feature. It may be recognized at once by the longitudinal grooving of the upper incisors, a feature not shared by any other South American mice as far as is known, and only again met with among American *Murina* in the North American genus *Ochetodon*. But we are satisfied, from our study of Waterhouse's perspicacious accounts, that in this case the grooving of the incisors is a character merely incidental to two genera otherwise widely separated; for in several points of cranial structure, and many external features, *Ochetodon* is very unlike *Reithrodon*. The former includes little animals whose general appearance may be summed up as that of *Mus musculus*, while the latter comprises large species with a strikingly rabbit-like appearance (see also under *Ochetodon*).

Indeed, we are not satisfied that the three species originally referred to *Reithrodon* do not themselves share sulcation of the superior incisors as a character only incidental to two different types of at least subgeneric value. They certainly differ notably in several cranial peculiarities as well as external features. There is a remarkable difference in the shape of the plate inclosing the anteorbital foramen, in the details of the palatal structure, and in the form of the under jaw; while there are external characters in the proportions of the tail, feet, and ears. In the respects of palatal structure and the form of the anterior zygomatic root, there is a curious analogy to the same points as distinguishing *Sigmodon* and *Oryzomys* from each other. We may tabulate the distinctive characters of *Reithrodon*, and of *Euneomys*, as we have termed the new subgenus, as follows:—

*Reithrodon*, WATERHOUSE.—Anterior root of zygoma deeply emarginated in front. Palate ending much behind the molar series, and showing a median ridge intervening between lateral paired deep excavations. Pterygoid fossæ deeply excavated, and the bones very closely approximated. Incisive foramina reaching beyond first molars. Condyloid process of lower jaw concave internally; descending process rounded off inferiorly; coronoid process very oblique.—TYPE, *R. cuniculoides*.

*Euneomys*, Nov., Proc. Acad. Phila. 1874, 186.—Anterior root of zygoma about straight in front. Palate ending nearly opposite the last molars, slightly ridged or excavated. Pterygoid fossæ shallow and these bones less approximated. Incisive foramina reaching only to first molars. Condyloid process of lower jaw flat internally; descending process angular; coronoid process nearly vertical.—TYPE, *R. chinckilloides*.

There are other differences in the relative proportions of the skull; and doubtless additional diagnostic features could be adduced, but these will suffice.

Aside from the grooving of the upper incisors, the dentition of this genus is of the ordinary sigmoid pattern, calling for little further comment. The incisors, as usual in the subfamily, are deeper anteroposteriorly than they are wide across. The molars decrease regularly in size and complexity from before backward; the front upper one has two external and two internal folds of enamel, the resulting three saliences on each side being about opposite each other, while the two reentrances from each side, which meet on the face of the tooth, are alternate. The other two upper teeth have but one internal and two external folds; the posterior one of the latter, in each tooth, being much deeper and more tortuous than any of the others. The front under molar shows on the outer side three perfect reentrant loops, and on the inner side two such, but may have one additional slight loop on each side, from indentations of the anterior end of the tooth. The mid-lower molar has two folds on the outside and one on the inner side, sometimes, however, with trace of another. The back lower molar has but one fold on either side; these

alternato, and in some stages of wear show a perfect letter S, at one time supposed to be characteristic of the genus *Sigmodon*, but now known to be a pattern of common, if, indeed, it be not of universal, occurrence among American *Murina*.

The genus appears to be confined to the southern part of South America, from which three species have been described. Two of these, *R. cuniculoides* and *R. chinchilloides*, are sharply distinguished by the characters already pointed out, and others; but the differences between *R. cuniculoides* and *R. typicus* are not so clear. It seems to us probable that the latter will prove to be, if not identical with, at most only a geographical race of *cuniculoides*—the ascribed characters appear, according to our experience with this family, to be within an ordinary range of variation in the same species. But without specimens we cannot, of course, presume to say that such is the case; and we redescribe the three species, as we have the genus itself, from Waterhouse's original notices.

#### REITHRODON CUNICULOIDES, Waterhouse.

*Reithrodon cuniculoides*, WATERHOUSE, Proc. Zool. Soc. 1837, 30; Zool. Voy. Beagle, pt. ii, 60, pl. xxvi (animal), pl. xxxiii, figs. 2b, 2c, 2d, 2e (teeth), pl. xxxiv, figs. 2a, 2b, 2c (skull).

DIAGNOSIS.—Yellowish-gray mixed with black; throat and belly pale yellow; rump and feet white; ears of medium size, yellowish, with a yellowish-white patch behind them; tail about half as long as the head and body, bicolor, dusky above, white below. Length, 6½; tail, 3½; hind feet, 1½; ear, ¾. HABITAT.—Patagonia (Port Desire, Saint Julian, Santa Cruz; *Darwin*).

The fur is described as long and soft; the general color of the upper parts is "grayish-brown with a considerable admixture of yellow"; the sides are yellowish-gray, paler below, fading into yellowish-white underneath, and there is a patch of the same behind the ears, which are also yellowish; moustaches very long and numerous, black and gray; soles partly hairy; hairs of the tail sufficient to hide the annuli, dusky above, white below; incisors yellow. The dimensions of a skull are given as follows:—Length, 1½; width, ¾. The teeth are very satisfactorily figured, enlarged in the plate above cited, while a glance at plate 26 is sufficient to show the curious general appearance of the species which suggested its specific name.

#### REITHRODON TYPICUS, Waterhouse.

*Reithrodon typicus*, WATERHOUSE, Proc. Zool. Soc. 1837, 30; Zool. Voy. Beagle, pt. ii, 1839, 71, pl. xxxiii, fig. 4a (teeth).

As described, this supposed species differs from the last in being smaller, with shorter feet and longer ears, and of darker color. The dimensions assigned are, length, 6 inches; hind foot, 1 inch ¾ lines; ear, 8½ lines. From La Plata (Maldonado, *Darwin*).

As already intimated, we admit the species on probation, suspecting it will not prove distinct from *cuniculoides*. It does not appear why it was named "typicus", since the genus appears to have been drawn up from the better-known *cuniculoides*, which must stand as the type of *Reithrodon*. *R. chinchilloides* was not described until two years afterward.

#### REITHRODON (EUNEOMYS) CHINCHILLOIDES, Waterhouse.

*Reithrodon chinchilloides*, WATERHOUSE, Zool. Voy. Beagle, 1839, pt. ii, 72, pl. xxvii (animal); pl. xxxiv, figs. 20a, 20b, 20c, 20d, 20e, 20f (skull and teeth).

*Reithrodon (Euneomys) chinchilloides*, COUËS, Proc. Acad. Nat. Sci. Phila. 1844, 185.

DIAGNOSIS.—Cinereous, washed with yellowish-dusky, under parts yellowish-white; tail dusky above, white below, half as long as the head and body; ears and tarsi rather short. Length, 5 inches; tail, 2½; tarsus, 1; ear, hardly ¾. Skull, 1½ long, 8½ lines wide.

HABITAT.—Straits of Magellan.

We have already detailed the notable structural characters by which this species differs from *cuniculoides* or *typicus*; and the plate above cited shows an animal of different external appearance. It is smaller, with apparently disproportionately smaller members, the color different, and the fur particularly long and soft—a circumstance suggesting its specific name, although it has, like *cuniculoides*, the curious rabbit-like aspect characteristic of the genus.

## GENUS OCHETODON, Coues.

× *Mus* sp., AUD. & BACH.

× *Hesperomys* sp., WAGNER.

= *Reithrodon*, LeCONTE, Proc. Acad. Nat. Sci. Phila. 1853, 413.—BAIRD, M. N. A. 1857, 447. *Not of Waterh.*

= *Ochetodon*, COUES, Proc. Acad. Nat. Sci. Phila. 1874, 194.

CHARS.—With the general appearance of *Mus* proper, but the essential characters of *Hesperomys*, except that the superior incisors are deeply grooved lengthwise. Tail about as long as the head and body.

The occurrence in North America of sigmodont mice with sulcate incisors was first made known in 1841 by Audubon and Bachman, who described *Mus humilis*. Their animal was almost immediately referred to *Hesperomys* by Wagner. These authors overlooked, or, at any rate, did not take into special consideration, the remarkable condition of the upper incisors, and it was not until twelve years subsequently, in 1853, that Major LeConte took up this point and referred a species to the South American genus *Reithrodon* of Waterhouse. In this course, he was followed, in 1857, by Professor Baird, who united two of Audubon and Bachman's species (*humilis* and *lecontei*) in one, gave *Mus carolinensis*, Aud. & Bach., as a doubtful species of the genus, and described three new ones, *R. montanus*, *R. megalotis*, and *R. longicauda*.

Although adopting *Reithrodon* after Waterhouse, Professor Baird comments at length upon the obvious differences between the North American mice with grooved incisors, and the several species of *Reithrodon* from South America, expressing his surprise at the re-appearance of the genus in the United States. Without an opportunity of direct comparison, however, he refrained from separating the North American *Ochetodon* from *Reithrodon*, although he indicated some of the prominent distinctions.

We regret that, like Professor Baird, we are unable to make the direct comparisons of *Reithrodon* and *Ochetodon* that are needed, having neither skins nor skulls of the former for examination. Judging from the figures and descriptions that have been published of *Reithrodon*, we are satisfied that the genus we have founded will prove valid; and, indeed, we should not be surprised if the grooved incisors proved to be the chief character that *Ochetodon* and *Reithrodon* share in common. As is well known, the South American *Sigmodonts* are almost without exception widely different from the North American; *Calomys* being the only one of them that closely approaches ours.

The following differential diagnosis may doubtless be largely supplemented with additional characters:—

*Sigmodont Murinae with grooved upper incisors:*

*Reithrodon*.—Form stout, leporine. Size very large. Tail half as long as the trunk.

*Ochetodon*.—Form slender, murine. Size very small. Tail averaging as long as the trunk.

With typical examples before us of all but one of the described species of *Ochetodon*, we are able to notice the genus with entire precision.

*Ochetodon* comprises the smallest Murines of North America; the smallest mammals of this continent, excepting some of the *Soricidae*. In general appearance, they are hardly distinguishable on sight from ungrown house-mice, they conform to the latter so closely in size, proportions, and color. The teeth, however, at once distinguish them from *Mus*; the molars being sigmodont, as in all *Murinae* indigenous to the New World, and almost exactly as in North American *Hesperomys*, while the sulcate incisors are *sui generis*.

The remarkable sulcation of the upper incisors is unique among North American *Murinae*, though recurring in the arvicoline genus *Synaptomys*. (It is much as in *Zapus*, which latter, however, is the type of a family apart from *Muridae*.) The grooves are deep and conspicuous, and nearly as broad as the prominent face of the tooth on either side; they are median in situation, run the whole length of the tooth, and terminate in a notch, so that the conjoined ends of the pair of incisors present four points instead of a straight bifid edge. The anterior face of each incisor is a prominent rounded ridge on either side of the groove; but the face, as a whole, is so much beveled off externally that, when the tooth is viewed in lateral profile, one of these ridges is entirely in front of the other, and the tooth appears double by the amount of separation that the groove affords. As usual in *Murinae*, each incisor is deeper antero-posteriorly than it is wide transversely; but the incisors differ noticeably from those of *Hesperomys*, &c., in their great curvature, which is sufficient to cause their apices to fall behind a perpendicular let down from the tip of the nasal bones.

The under incisors are simple, and, with the entire molar series, much as in *Hesperomys*. But there seems to be a difference in the rooting of the molars. In all the *Hesperomys* examined, the anterior upper molar, at least, invariably showed us three roots, making as many distinct perforations of the alveolus: two exteriorly, in a line with each other; and one interior, midway

between the two outer ones. In *Ochetodon*, the same molar has *four* roots: three large ones, just as in *Hesperomys*; and an additional very small exterior one, midway between the other two exterior ones. The second molar (in No. 2282 for example) has only three evident ones, but a similar, only very minute, fourth one also appears. The last upper molar makes but two perforations. Some difference in the molar crowns of *Hesperomys* and *Ochetodon*, corresponding to the different rooting in the two genera, may yet be established. This additional root of *Ochetodon* is an approach toward *Mus* proper; for, in an example of *M. decumanus* before us, we find that the alveolus of the upper anterior molar is perforated with *six* distinct holes.

There are several remarkable peculiarities in the skull besides the grooved upper incisors. Prominent among these is the singular shape of the descending process of the under jaw. This is really a subquadrate plate, retaining the essential characters that here mark off *Murina* from *Arvicolina*, but, nevertheless, when viewed in lateral profile, more nearly resembles the characteristic hamular process of the *Arvicolina*. This appearance is due to the abrupt inward inflection nearly at right angles of the lower border of the process; nothing like this is seen in *Hesperomys*, &c. The coronoid is very small and acute, and curves very obliquely backward. The inside of the ramus of the jaw shows, as usual, a ridge denoting the passage of the under incisor up toward the condyle. The skull as a whole is broader and shorter than in *Hesperomys*; the lengthwise convexity on top is greater, and the cranium is quite as wide across the parietal portion as between the zygomata. The latter dip deeply down to the level of the palate, but do not stand out much, their middle portions being nearly parallel. There appears to be a peculiarity in the anteorbital foramen, which is settled far into the zygomatic part of the maxillary, and, of a consequence, appears almost circular above, suddenly contracting into a narrow slit below (somewhat as in *Oryzomys*; in *Hesperomys* proper, the broad upper part of the foramen is rather pyriform, and narrows gradually below). The incisive foramina are large and very long, reaching from a point opposite the anterior molars almost to the incisors. The palate ends behind abruptly as a transverse shelf, opposite the back border of the last molars; but this shelf-edge is very narrow from side to side, owing to the close approximation of the nearly parallel pterygoid ridges; and, on either hand, the palatal level almost directly continues into the shallow depressions, of unusual width, that lie between it and the bullæ auditivæ.

(In all this, however, there is nothing essentially different from *Hesperomys*.) The latter are very large and thin, and widely separated by a broad wedge-shaped basioccipital, their axes rapidly approximating from behind forward.

In external form, there is little or no difference from *Hesperomys* to note. The hairiness of the tail and ears is much as in that genus, and more than in *Mus*. The tail averages about as long as the head and body—a little less in *O. humilis*, and a little more in *O. longicauda* and *O. mexicanus*. The fore feet are about half as long as the hind ones; both are rather scant-haired above, though the hairs reach to the end of the claws. The palms show the ordinary five tubercles. The soles are scantily hairy for about one-third their length, being for the rest granular-reticulate, with six very distinct tubercles: the first internal, midway between heel and base of inner toe; the second just in advance of this, but external; the third in advance of the second, but internal and at base of the inner toe; a fourth and fifth lie at bases of, respectively, the fifth and second toes; the sixth rests upon the conjoined bases of the third and fourth toes.

We append the measurements of several skulls of *Ochetodon*, without distinction of species, since no specific characters rest upon peculiarities of the cranium.

TABLE XXXII.—Measurements of five skulls of OCHETODON.

Number.	Locality.	Length.	Width at zygoma.	Width at orbita.	Height.	Molar series.	Tip of under incisors to—			Species.
							Condyle.	Coronoid.	Descend'g process.	
1533	Saint Louis, Mo.....	0.76	0.40	0.12	0.39	0.14	0.47	0.37	0.46	<i>humilis</i> .
1534	Sonora.....	0.82	0.43	0.13	0.30	0.15	0.50	0.40	0.40	" <i>megalotis</i> ."
1535	Rocky Mountains.....	0.78	0.40	0.11	0.28	0.13	0.48	0.38	0.45	" <i>montanae</i> ."
1536	Petaluma, Cal.....	0.69	0.38	0.11	0.26	0.12	0.42	0.31	0.40	<i>longicauda</i> .
1537	.....do.....	0.70	0.40	0.12	0.27	0.13	0.47	0.35	0.46	.....do.

\* No. 2538 is, perhaps, not quite full-grown.

### OCHETODON HUMILIS, (Aud. & Bach.) Coues.

#### Little Harvest Mouse.

*Mus humilis*, AUD. & BACH., Proc. Acad. Nat. Sci. Phila. i, 1841, 97; Journ. Acad. Nat. Sci. Phila. 1842, viii, pt. ii, 300; Q. N. A. ii, 1851, 103, pl. lxx (South Atlantic States).

*Hesperomys humilis*, WAGNER, Wieg. Arch. 1843, pt. ii, 51 (after Aud. & Bach.).

*Reithrodon humilis*, BAIRD, M. N. A. 1857, 448 (South Carolina, Georgia, and Missouri).

*Ochetodon humilis*, COUES, Proc. Acad. Nat. Sci. Phila. 1874, 186.

*Mus lecontei*, AUD. & BACH., Journ. Acad. Nat. Sci. Phila. viii, 1842, 307; Q. N. A. iii, 1854, 334 (*sub. aulica*), (South Carolina).



*Hesperomys lecontei*, WAGNER, Wieg. Arch. 1843, pt. ii, 51 (after Aud. & Bach.).

*Reithrodon lecontei*, LECONTE, Proc. Acad. Nat. Sci. Phila. vi, 1853, 413.

? *Mus carolinensis*, AUD. & BACH., Journ. Acad. Nat. Sci. Phila. viii, pt. ii, 1842, 306; Q. N. A. iii, 1854, 332. (South Carolina, in inundated lands, rare. "Tail longer than the body, ears long and hairy, color light plumbeous; \* \* \* under surface scarcely a shade lighter. Length of head and body 2.33, of tail 2.75, ear 0.33, tarsus 0.54.")

? *Hesperomys carolinensis*, WAGNER, Wieg. Arch. 1843, pt. ii, 51 (after Aud. & Bach.).

? *Reithrodon carolinensis*, BAIRD, M. N. A. 1857, 452 (after Aud. & Bach.).

*Reithrodon megalotis*, BAIRD, M. N. A. 1857, 451; Rep. U. S. and Mex. Bound. Surv. ii, pt. ii, 1859, Mammals, 43, pl. vii, fig. 4a-c, and pl. xxiv, fig. 4a-g. (Sonora. Largest of North American species. Head and body, 24-3; tail, 2½; sole, 1-1½; ear, 0.43 high. Colors as in *E. humile*.)

DIAGNOSIS.—*O. mure musculo minor seu staturâ subæquans, caudâ truncum subæquante hirsutâ, sub-bicolore, auriculis prominulis, hirsutis, plantis semi-nudis, vellere molli, supra murino, infra griseo-albido, lateribus fulvescentibus.*

HABITAT.—South Atlantic States. Gulf States into Sonora. Up the Mississippi Valley to Saint Louis. Iowa. Kansas. Nebraska.

Numerous excellent examples, from the South Atlantic States, of this diminutive Rodent, which, with the general appearance of a small house-mouse, is instantly distinguished by its generic characters, present very little variation either in size, shape, or color. None show the peculiar proportions attributed by Audubon and Bachman to their *Mus carolinensis*. The tail is always a little shorter than the trunk. The hind feet range from 0.50 to 0.60 in length; the ears project beyond the fur, and have a somewhat characteristic shape, difficult to describe, represented with indifferent success in Audubon's plate above cited. They are rather obovate in shape, and narrow for their length; the antitragus is valvular; the interior below is nearly naked and flesh-colored; this part is overlaid by the long hairs of the cheeks; the rest of the ear is rather coarsely hirsute than closely pilous. The fur is soft and silky; above, the color is exactly as in the house-mouse and nearly uniform, being merely a little darker along the middle of the back; but all along the sides the brown is enlivened with a decided wash of fulvous or pin'sh-gray, never seen in *M. musculus*. Generally, this tinge is diffuse, but it sometimes forms quite a striking lateral stripe. The tail is distinctly bicolor, but not very sharply so. The under parts are whitish, obscured by the plumbeous of the roots of the hairs showing through, and generally also noticeably washed over with a dilution of the fulvous that tinges the sides. The lips, however, are pure white; and the whole oral and mental region, with the upper surface of the feet, are likewise white. The absolute size, and to some extent the range of variation, of this species appear from the table given below.

The Kansas specimens there enumerated are identical in every respect with typical Carolina and Georgia ones, but with this exception: we find that directly we turn from South Atlantic to other skins we are met by a deviation from the type that threatens difficulty in determination of other western forms that have been described as distinct. Thus, the two Saint Louis skins, 569-570, have the tail at least equaling the head and body. They are, however, in too imperfect condition to admit of positive determination, and we assign them to *humilis* with a query, just as Baird did. The Nebraska skin, No. 3095, shows the same thing; but the tail has been skinned and stretched on a straw, so that probably in life it was really shorter than the head and body. It further differs in its paler colors; but this is like what is seen in the *Hesperomys*, *Neotoma*, and *L. vicola*, from the same region, and need not worry us at all. The Iowa skin, No. 9339, is one of the largest we have ever seen, and unusually bright fulvous on the sides—not pale like the Nebraskan, nor dark like the Carolinian. It falls, however, within ordinary limits of variation, and does not excite a suspicion of distinctness.

The *Mus lecontei* of Audubon and Bachman is certainly the same as their *M. humilis*; but the determination of their *M. carolinensis* offers some difficulty, as the description above quoted ascribes characters that we do not recognize in our specimens from Carolina. We have never seen an *Ochetodon* from the South Atlantic States with a tail even equaling the head and body, much less as 2.33 to 2.75, nor a specimen from any locality in which the under parts were not decidedly lighter than the upper. But as it is improbable that a second good species, differing as these authors say, occurs in South Carolina alongside *O. humilis*, we are forced to believe either that there is some mistake in the measurements given\* and colors ascribed, or else that *O. humilis* varies to the degree indicated in the description of *Mus carolinensis*. This latter supposition is very likely; we have already cited instances of color-variation quite as great as those ascribed to *carolinensis*, and have seen, in Saint Louis and other specimens, tails at least equaling, if they do not exceed, the head and body. After all, the variation in this latter respect is quite within the limits we elsewhere establish for species of *Hesperomys*, *Sigmodon*, and other genera. The case is noteworthy in connection with the long-tailed species *O. longicauda*, that we next describe.

There can be but little doubt, and there is none at all in our mind, that

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\* More glaring inaccuracies than this occur in the work in question.

the *Reithrodon megalotis* is the same as *O. humilis*. The colors are confessedly the same. The height of the ear (0.43) that is dwelt upon is no greater than occurs in typical *humilis* (see table). The size (3.00) of one of the two type-specimens is greater than we have ever determined for *humilis* by four-tenths of an inch, but the other type (2.42 long) is well within the ordinary range of *humilis*. It is interesting to observe that these two animals (Nos. 1039, 1040, from Sonora, Dr. Kennerly) do not approximate toward either *O. longicauda* nor to the still larger and longer-tailed *O. mexicanus*.

TABLE XXXIII.—Measurements of twenty-six specimens of *OCHETODON HUMILIS*.

Number.	Locality.	Collector.	Nose to—				Tail vertebrae.	Fore feet.	Hind feet.	Height of ear.	Nature of specimen.
			Eye.	Ear.	Occiput.	Tail.					
2535	Society Hill, S. C.	M. A. Curtis	0.38	0.77	0.88	2.42	2.25	0.30	0.60	.....	Alcoholic.
2536	.....do.....	.....do.....	0.40	0.80	0.90	2.10	2.01	0.28	0.60	.....	.....do.
2537	.....do.....	.....do.....	0.33	0.66	0.85	2.10	1.90	0.27	0.50	.....	.....do.
2538	.....do.....	.....do.....	0.35	0.70	0.86	2.15	1.97	0.28	0.57	.....	.....do.
1064	.....do.....	.....do.....	.....	.....	.....	2.10	1.65	0.27	0.62	0.40	Dry.
1259	.....do.....	.....do.....	.....	.....	.....	.....	1.85	0.28	0.58	0.41	.....do.
1260	.....do.....	.....do.....	.....	.....	.....	2.40	2.00	0.41	0.61	0.41	.....do.
1905	.....do.....	.....do.....	.....	.....	.....	1.40	1.75	.....	0.59	.....	.....do.
2248	Liberty County, Ga.	J. LeConte	.....	.....	.....	2.30	.....	.....	0.58	0.39	.....do.
4609	.....do.....	.....do.....	.....	.....	.....	2.15	.....	0.00	0.43	.....	.....do.
4700	.....do.....	.....do.....	.....	.....	.....	2.30	2.00	.....	0.41	0.40	.....do.
4701	.....do.....	.....do.....	.....	.....	.....	2.60	1.90	.....	0.58	.....	.....do.
4948	Southern United States	.....f.....	0.35	0.75	0.89	2.15	1.90	0.27	0.58	0.41	Alcoholic.
5598	Neosho Falls, Kans.	B. F. Goss	.....	.....	.....	2.55	2.30	.....	0.62	.....	Fresh, except feet.
5597	.....do.....	.....do.....	.....	.....	.....	2.33	2.20	.....	0.63	.....	.....do.
8598	.....do.....	.....do.....	.....	.....	.....	2.37	2.25	.....	0.64	.....	.....do.
8599	.....do.....	.....do.....	0.35	0.75	0.89	2.30	1.70	0.28	0.62	0.40	Alcoholic.
8590	.....do.....	.....do.....	0.33	0.70	0.80	2.00	2.00	0.25	0.60	0.58	.....do.
8133	Burlington, Kans.	A. Crocker	.....	.....	.....	2.00	1.90	.....	0.64	.....	Dry.
9539	Buchanan County, Iowa.	G. & C. Blackburn	.....	.....	.....	2.60	2.10	.....	0.65	.....	.....do.
3065	Pole Creek, Nebr.	W. S. Wood	.....	.....	.....	2.50	2.50	.....	0.64	.....	.....do.
1569	Saint Louis, Mo.	G. Engelmann	.....	.....	0.75	2.00	2.00	.....	0.64	.....	Alcoholic.
1570	.....do.....	.....do.....	.....	.....	.....	1.75	1.75	.....	0.61	.....	.....do.
7302	Calcasieu Pass, La.	G. Wüldemann	0.38	0.70	0.80	2.00	2.00	0.30	0.66	0.37	.....do.
4057	Camp Floyd, Utah	C. S. McCarthy	0.33	0.62	0.82	2.00	1.70	0.23	0.60	0.46	.....do.
9997	.....do.....	.....do.....	0.34	0.63	0.83	2.00	1.80	0.24	0.61	0.39	.....do.

\* This is the identical length of body ascribed to the smaller of the two specimens of "*megalotis*".

† This is the identical length of ear ascribed to the larger of the two specimens of "*megalotis*".

### OCHETODON LONGICAUDA, (Baird) Coues.

*Reithrodon longicauda*, BAIRD, M. N. A. 1857, 451 (California).—TOMES, Proc. Zool. Soc. 1861, 234 (Guatemala).

*Ochetodon longicauda*, COUES, Proc. Acad. Nat. Sci. Phila. 1874, 186.

DIAGNOSIS.—*O. humilis* similis, sed cauda longiore, truncum superante, et pedibus paululum validioribus; coloribus magis flavicantibus. Long. tot. 2-2½, cauda 2½-3, pedis ¾.

HABITAT.—California (*Samuels, Stimpson, Xantus*). ?Guatemala (*Tomes*).

"Size small. Tail considerably longer than the head and body (which measure from 2.10 to 2.30 inches), usually from 3 to 8 tenths of an inch longer. Hind foot .65 to .70 of an inch. Above, dark brown: beneath, white, tinged with reddish yellow. A broad wash of bright fulvous on the sides and cheeks."—(*Baird, l. c.*)

This animal, accurately indicated by Baird as above, is certainly distinguishable from *O. humilis*, though the full question of its specific difference from *humilis* is perplexing. While we have never seen an Atlantic *Ochetodon* with the tail even as long as the body, and while even in the Middle Region the tail never exceeds the trunk, there is no example of *longicauda* in which this member is not notably longer. The trunk ranges, as shown by the following table (mostly copied from Baird's published one), from 1.83 to 2.40, settling near 2.25 as an average, while the tail ranges from 2.25 to 3.15, only once, however, touching this last figure, and usually falling under 3.00. The feet, likewise, are somewhat larger, ranging from 0.60 to 0.70, with an average of 0.66, only once reaching 0.70, and perfectly connected with those of *humilis* by intermediate measurements; though in *humilis* the feet rarely reach 0.66, and will not average over 0.60. The colors of *longicauda* are likewise noticeably different; only a restricted dorsal area is as dark as in ordinary *humilis*, while the whole sides of the head and body are broadly and brightly fulvous, and the under parts are washed with the same. This lively shade is not even approximately attained in any specimen we have seen except 9339 from Iowa.

We have, therefore, little hesitation in indorsing the name, though certain facts arouse our suspicion and prevent us from making out a perfectly satisfactory case. Thus, Audubon and Bachman have described a Carolina animal nearly identical with *longicauda* in proportions. Then, again, in our specimens from intermediate localities, as Missouri, Iowa, and Nebraska, the tail lengthens to an equality with the body, and the feet average over 0.60. The question is resumed and more fully stated under head of the next species, *mexicanus*. We cite the above Guatemalan reference with a query, suspecting that this particular form does not occur in that locality; but, of course, we have no assurance that such is not the case.

TABLE XXXIV.—Measurements of twenty specimens of *OCHETODON LONGICAUDA*.

Number.	Locality.	Collector.	From tip of nose to				Tail to end of vertebrae.	Length of—		Nature of specimen.
			Eye.	Ear.	Occiput.	Tail.		Fore foot.	Hind foot.	
7750	San Francisco, Cal. ....	W. Stimpson .....	0.40	0.72	0.88	.....	2.70	0.28	0.63	Alcoholic.
7751	Fort Tejon, Cal. ....	J. Xantus .....	0.37	0.65	0.85	2.30	2.40	0.25	0.61	do.
9897	Monterey, Cal. ....	C. S. Canfield .....	0.30	0.76	0.90	2.30	2.00	0.29	0.66	do.
10349	do. ....	do. ....	0.34	0.75	0.88	2.15	2.00	0.28	0.67	do.
10350	do. ....	do. ....	0.35	0.70	0.88	2.30	2.30	0.25	0.64	do.
1418	Petaluma, Cal. ....	E. Samuels .....	.....	.....	0.75	2.06	2.25	0.25	0.62	Fresh.
1583	do. ....	do. ....	.....	.....	0.83	1.98	2.25	0.25	0.62	do.
1419	do. ....	do. ....	.....	.....	0.63	2.43	2.42	0.23	0.68	do.
2381	do. ....	do. ....	0.33	0.70	0.90	2.15	2.50	0.25	0.65	Alcoholic.
2382	do. ....	do. ....	0.55	0.69	0.86	2.15	2.45	0.30	0.65	do.
2383	do. ....	do. ....	0.40	0.60	0.95	2.10	2.80	0.39	0.68	do.
2384	do. ....	do. ....	0.33	0.73	0.10	2.10	2.40	0.38	0.60	do.
2385	do. ....	do. ....	0.35	0.70	0.10	2.13	3.15	0.30	0.70	do.
2386	do. ....	do. ....	0.30	0.65	0.84	2.06	2.35	0.25	0.65	do.
2387	do. ....	do. ....	0.40	0.73	0.90	2.30	2.65	0.30	0.66	do.
2388	do. ....	do. ....	0.40	0.70	0.90	2.00	2.00	0.30	0.65	do.
2389	do. ....	do. ....	0.40	0.80	0.10	2.40	2.88	0.31	0.65	do.
2390	do. ....	do. ....	0.38	0.79	0.90	2.10	2.70	0.30	0.66	do.
2391	do. ....	do. ....	0.68	0.70	0.87	2.30	2.65	0.30	0.60	do.
10013	do. ....	do. ....	.....	.....	1.65	2.00	0.25	0.64	do.	do.

*OCHETODON MEXICANUS*, (De S.) Coues.

*Reithrodon mexicanus*, DE SAUSSURE, Rev. & Mag. Zool. 1860, p. — (p. 27 of the separate reprint).—TOMES, Proc. Zool. Soc. 1861, 284 (Guatemala).

*Ochetodon mexicanus*, COUES, Proc. Acad. Nat. Sci. Phila. 1874, 196.

DIAGNOSIS.—*O. maximus*, caudâ trunco longiore, pedibus validissimis, murino-brunneus, subtus ex brunneo albidus, lateribus subflavicantibus. Long tot.  $2\frac{1}{2}$ –3, caudæ  $3\frac{3}{4}$ , pedis 0.70–0.80.

HABITAT.—Mexico (*De Saussure*, *Sumichrast*). Guatemala (*Tomes*). Louisiana (*Saint Charles College*).

Larger than either of the foregoing; upward of 3 inches long, with the tail averaging  $3\frac{1}{2}$ , thus much exceeding the head and body, as in *O. longicauda*, but feet much larger than in that species, 0.70 to 0.80 (whereas the feet of *longicauda* are barely larger than those of *humilis*, very seldom touching 0.70). Upper parts a rather warm mouse-brown (rufous or dull ferruginous, not mouse-gray), which on the sides usually grows brighter, and is sometimes almost orange-brown; this, again, fading on the under parts into a muddy-whitish (not white at all). Tail extremely scant-haired, nearly as naked as in *Mus musculus*, in dried specimens appearing nearly unicolor; in alcoholic ones, dull pale brown above and whitish underneath. Hands and feet whitish above (like the tail underneath).

We have no doubt that Professor Sumichrast's specimens represent typically the *Reithrodon mexicanus* of De Saussure. Though they present some discrepancies in dimensions, De Saussure's measurements, he says, are probably a little under the mark, while Sumichrast's specimens seem a little stretched; this is enough to bring about perfect concordance.

Our Louisiana specimens are highly interesting, as showing for the first time the occurrence of the true Mexican form in the United States. They are unquestionably identical with Sumichrast's examples from Tehuacan, and agree even better than these with De Saussure's figures. The discovery of this style of *Ochetodon* in the United States is especially important in its bearing upon the identification of *Mus carolinensis*, Aud. & Bach. Nos. 7748-7749 agree with the account of *carolinensis* in length of tail, and in the dullness of color of the under parts; and it may be, after all, that this long-tailed *mexicanus* ranges coastwise up to the Carolinas. Still, there are discrepancies that cannot be overlooked between Audubon's description and the present animal, especially as to the size of the feet; and we are not at present warranted in calling the form *Ochetodon carolinensis*. The latter name must be assigned, with a query, as a synonym of *humilis*, at least until we find the long-tailed large-footed form in Carolina.

That there is a regular gradation in length of tail and size of foot between *humilis* on the one hand and *mexicana* on the other is undeniable; and if we could have proven in the genus *Ochetodon* the same amount of variation with locality that has always been admitted in the case of *Zapus hudsonius*, and that obtains with *Hesperomys leucopus* and *Arvicola riparius*, we should be forced to merge the three supposed species into one, with two geographical variations. Failing in this, however, at present, we can, at any rate, conveniently mark off three kinds of *Ochetodon*. The following analysis (in which coloration, which though an aid in identification, may not be always reliable, is omitted) will, it is believed, enable us to readily distinguish ninety per cent. or more of our specimens:—

A. Tail shorter than head and body (at most barely equaling head and body).

a. Hind feet under 0.70 long (usually 0.55-0.65)..... HUMILIS.

B. Tail longer than head and body.

b. Hind feet under 0.70 (exceptionally just reaching 0.70). LONGICAUDA.

c. Hind feet over 0.70 (rarely, if ever, falling to 0.70)... MEXICANUS.

TABLE XXXV.—Measurements of eleven specimens of *OCHETODON MEXICANUS*.

Number.	Locality.	Collector.	Nose to—				Tail.	Fore foot.	Hind foot.	Ear.	Remarks.
			Eye.	Ear.	Occiput.	Tail.					
7748	Grand Coteau, La .....	Saint Charles College.	0.35	0.68	0.89	2.40	3.90	0.33	0.77	0.50	Alcoholic.
7749	do .....	do .....	0.42	0.78	0.96	2.75	3.75	0.36	0.82	0.45	do.
7007*	Tehuacan, Mexico .....	F. Sumichrast .....	0.45	0.80	1.00	3.00	3.75	0.35	0.80	0.50	Dry.
7007*	do .....	do .....	0.42	0.76	0.95	2.75	3.60	0.33	0.81	0.45	do.
7007*	do .....	do .....	0.43	0.80	0.95	2.75	3.10	0.30	0.78	0.47	do.
8390	Orizaba, Mexico .....	do .....	0.42	0.65	0.95	2.60	3.60	0.33	0.75	0.57	Alcoholic.
8459	Cordova, Mexico .....	do .....	0.40	0.78	0.94	2.30	3.35	0.32	0.74	0.46	do.
8460	do .....	do .....	0.42	0.76	0.90	2.30	3.25	0.32	0.77	0.47	do.
7390	Mirador, Mexico .....	C. Sartorius .....	0.40	0.73	0.98	2.75	3.60	0.33	0.78	0.50	do.
*4802	do .....	do .....	0.44	0.80	1.00	2.50	3.40	0.33	0.77	0.50	do.
8303	do .....	do .....	0.43	0.74	0.92	2.50	3.35	0.32	0.75	0.53	do.

\* No. 4802 is a perfect albino, pure white everywhere, and doubtless had pink eyes.

*OCHETODON MONTANUS*. (*sp. proband.*)*Reithrodon montanus*, BAIRD, Proc. Acad. Nat. Sci. Phila. vii, 1855, 335; M. N. A. 1:57, 449, pl. liv, fig. No. 1306 (teeth), (Rocky Mountains, latitude 39°).

CHARS.—Very small; head,  $\frac{1}{2}$  of an inch; head and body, 2 $\frac{1}{2}$ ; tail, 2; hind foot,  $\frac{1}{2}$ ; ear,  $\frac{1}{4}$ . "Above brown and pale yellowish gray, much lighter than mouse color. Outside of ears and flanks, pale yellowish brown, without any rufous. Beneath, dull whitish."—(*Baird, l. c.*)

The type and only known specimen of this species (No. 1306, Mus. Smiths.), now before us, is one of the very smallest North American Rodents we ever saw, although, as Professor Baird says, it appears to be perfectly adult, from the worn teeth and other signs. It is somewhat less than ordinary adult *humilis*; it has, however, the same relative proportions of parts as in that species. In color, it is noticeably different from any other *Ochetodon*, being of the very palest kind of mouse-color above, the sides and under parts yellowish-gray, with barely a trace of the fulvous always noticeable in the other species. This coloration is exactly what we should expect after immersion in alcohol for some time, which we suspect to be the case, though we have no authority for stating that the specimen has been skinned out of spirits. The single specimen is too imperfect to permit of final characterization, or to enable us to come to any positive conclusion; but if the size and coloration it presents are really permanent, we should judge it entitled to recognition as a valid species. At present, however, we regard it with suspicion, and are unwilling to indorse its validity.

## SUBFAMILY ARVICOLINÆ.

The characters of the group having been given on page 2 in a manner which suffices for present purposes, and some analysis of the genera being represented in the table on pages 4-6, we may immediately proceed to consider the various genera and species successively in detail.

## GENUS EVOTOMYS, Coues.

< *Arvicola* sp., AUCTORUM.

< *Myodes*, SELYS-LONGCHAMPS, Études de Microm. 1839, 87.

= *Hypudæus*, KEYSERLING & BLASIUS, Wirbelth. 1842 (type, *Arvicola glareola*), (not of Illiger, which includes *Mus lemmus*, *amphibius*, and *arvalis*).

= *Hypudæus*, BAIRD, M. N. A. 1857, 513, 515, 518 (type, *Arvicola gapperi*).

= *Evotomys*, COUES, Proc. Acad. Nat. Sci. Phila. 1874, 186 (type, *Mus rutilus*, PALL.).

The name "*Hypudæus*" appears to have been loosely, if not indiscriminately, used by authors; and, before proceeding to its definition, we wish to explain the above synonymy, in vindicating the necessity for a new generic name.

According to Agassiz, the name *Arvicola*, proposed by Lacépède in 1803, applied to *Mus amphibius* and *Mus arvalis*, and therefore, of course, is out of the question for the present genus.

According to Baird, the name "*Myodes*", as used by Selys-Longchamps (1839), is the same as *Hypudæus*, Illiger, and therefore conflicts with *Myodes*, Pallas, of same date, applied to the Lemmings.

"*Hypudæus*", Illiger, 1811, included *Mus lemmus*, *amphibius*, and *arvalis*, and is therefore inapplicable to the present genus.

But Keyserling and Blasius, in 1842, in separating the old genus *Arvicola* into two sections, retained the name *Arvicola* for the largest and most comprehensive of these, and applied Illiger's term *Hypudæus* to the restricted group, of which *Mus rutilus*, *rubidus*, *glareola*, *gapperi*, &c., are typical. Baird, in 1857, used *Hypudæus* precisely in the same sense that Keyserling and Blasius had attached to it.

It is simply the old question: *Shall a synonym of one genus become the tenable name of another genus?* Here, *Hypudæus*, Illiger, a synonym of *Arvicola*, Lacépède, if not also a synonym of *Myodes*, Pallas, has been held by Keyserling and Blasius and by Baird as the distinctive name of a different genus. It is immaterial that these latter authors gave the term an entirely



different significance from that which Illiger attached to it. We hold that a name once shown to be a synonym of a previous name is, to all intents and purposes, *dead*, and cannot be revived for use in another connection. This decision, which, we think, will be granted to be sound and just by most naturalists, has obliged us to propose a new name for the genus of which *rutilus* is the type; for we cannot find that it has ever received a distinctive appellation, and it is well worthy of full generic rank.

**DIAGNOSIS.**—Generally like *Arvicola* proper in dentition, but molars each 2-rooted; middle lower molar like the last one, with three transverse triangles seriatim, instead of alternating lateral ones; lateral triangles of front lower molar rather opposite than alternate. Inward folds of enamel generally not perfectly fused along middle of tooth. Generally like *Arvicola* proper in external form, but ears distinctly overtopping the fur; closely pilous. Bony palate ending posteriorly with a straight transverse edge opposite the middle molar, the whole space between the last molars thus left open. Coronoid process of under jaw short, its apex far below the level of the condyle.

**TYPE.**—*Mus rutilus*, Pallas.

This interesting genus is truly arvicoline, not only in general external form, but in the prismatic molars and the structure of their crowns; at the same time, it shows decided affinities with the Murines proper, and seems to form a connecting link between them and *Arvicolinae*. In external form, the conspicuous ears are the chief departure from typical *Arvicola* and an approach toward murine forms; for exserted ears are rare in *Arvicolinae*, if not entirely confined to this genus and *Synaptomys*; while in *Murinae* they are the rule without signal exception. The ears of *Evotomys* do not reach the development witnessed in *Hesperomys* proper, but are almost as large as in *Onychomys*, and quite as large as in *Oryzomys*. The resemblance, in external form, to *Synaptomys*, is so close that we cannot point out any reliable distinctions; but *Synaptomys* is instantly distinguished by its peculiar cranial and dental features, as elsewhere detailed, these being, in fact, almost exactly as in the Lemmings (*Myodes*).

The most remarkable indication of murine affinity is seen in the rooted molars. The molars of *Murinae* are rooted, perhaps without a single exception; while the molars of *Arvicolinae* are normally rootless, with probably the single exception of the present genus *Evotomys*. But there is this difference in the mode of rooting between *Evotomys* and true murine forms: In *Evoto-*

*mys*, the molars have only two parallel roots apiece, one directly behind the other, and both broad; and the rooting is simply the closing-up of the ends of the roots from failure of the pulps that in other *Arvicolinæ* are supplied indefinitely, causing the roots to persist open. On the other hand, in *Murinae*, the roots of the molars are distinct diverging prongs, closed from the first; there are at least three such prongs (two external and one internal) in American *Hesperomys* or Sigmodont Murines, and even more in the Old World *Mus*, each perforating the alveolus separately. In *Evotomys*, there are but two such perforations of the alveolus, and these even are almost confluent.

From *Arvicola*, the next most signal difference of *Evotomys* is seen in the construction of the bony palate. In *Arvicola* (e. g. *amphibius* or *riparius*), the palate behind has a little pit, or fossa, on each side opposite the last molars, and the whole space between them is depressed; and this depression is fissured, or excavated, by the advance from behind of the inter-ptyergoid cavity, which either ends at the palate with a single curve, or with a double curve from the development of a little azygos process on the middle line of the posterior margin of the palate. "Thus," to use Baird's words, "there is a step from the plane of the bony palate to the bottom of the fossa, and another thence to the base of the skull or body of the sphenoid"; and the sides of the palate behind run out continuously into the pterygoids. Now, in *Evotomys*, all this depressed or fossate part of the palate is done away with; the palate ends by an abrupt transverse edge, as a straight shelf, opposite the middle molar (or rather opposite the space between the middle and last molar), leaving the excavation of the base of the skull apparent in the whole space between the last molars, and breaking all connection with the pterygoids. This construction of palate, so unusual in *Arvicolinæ*, is, however, again found, with no appreciable difference, in the Lemmings; but, singularly enough, the genus *Synaptomys*, which repeats *Evotomys* in external form and *Myodes* in dentition, has the palate constructed as in *Arvicola*. The curious interrelation of *Myodes*, *Synaptomys*, and *Evotomys* is sufficiently interesting without considering the murine affinities of the latter; but, while we are on the subject of the palate, we may here allude to some of its conditions in murine forms. In *Mus decumanus*, the palate behind has no step downward or depressed fossate part, as *Arvicola* has, ending as a straight, sharp, transverse shelf, as in *Evotomys*; but then it reaches as a continuous plane far behind the last molar, and runs directly into the pterygoids on either hand, the median excavation

being narrow. This style of *Mus* is substantially repeated in *Hesperomys*, *Reithrodon*, and *Sigmodon*, though in these the palate does not run quite so far back, stopping at or just behind the posterior border of the last molars. In *Neotoma*, on the other hand, the reverse occurs; for here the palate of *Evotomys* is almost repeated, in that the excavation runs forward to opposite the interspace between the last and penultimate molars; but there is this difference, that in *Neotoma* the posterior outline of the palate is deeply concave, and its sides run back continuously with the pterygoids.

The under jaw of *Evotomys* is unmistakably Arvicoline in its sharp, twisted, and upward-bent hamular process, reaching up to the level of the molar crowns. This form of the descending process is constant, so far as we are aware, and marks the subfamily *Arvicolinae* from the *Murinae*; for, in these last, the same process is a flattish, oblique, subquadrate plate, never attaining the level of the molars; and we have never seen an intermediate form. But the jaw of *Evotomys* has one character not shared by any other Arvicoline that we know of: the coronoid process does not attain the level of the condyle. This is owing, we believe, to its absolute shortness, as the length and obliquity of the condylar process itself appears about the same as in other Arvicolines. This state of the coronoid is only elsewhere found, among the genera we have studied in the preparation of this memoir, in *Ochetodon* and *Hesperomys* proper; for in the *Onychomys* and *Oryzomys* groups of this last, in *Neotoma*, *Sigmodon*, *Mus*, and all *Arvicolinae*, the apex of the coronoid mounts as high as, or even surmounts, the condyle.

The auditory bullæ of *Evotomys* are remarkably large, exceeding in their size and inflation those of any other genus with which we are acquainted. Thus, they are absolutely almost as large as in *Arvicola amphibius*, an animal twice as big. The nasal bones run back about as far as the nasal branches of the premaxillaries, both stopping abruptly opposite the anterior roots of the zygoma, and thus considerably in advance of the orbits. It is much the same in *Myodes* and *Synaptomys*; in other *Arvicolinae*, in *Mus*, *Hesperomys*, &c., these bones may be of decidedly different lengths, and one or the other—generally the premaxillaries—extends to the orbital region of the skull. As in all *Arvicolinae*, the upper incisors are broader than deep; and as in all these, except *Myodes* and *Synaptomys*, the under incisors run past the last molar up the condylar process of the jaw.

The foregoing appear to be the chief characters of *Evotomys*, if they be

not all there are; and as a *résumé* of this attempt to indicate fully the relative position of the genus among its congeners, we may say *Evotomys* is a true Arvicoline, yet it stands near the boundary between *Arvicolinæ* and *Murinæ*, and especially approaches *Onychomys* of the latter subfamily; and that, though thus a connecting link between the two subfamilies, nevertheless it stands in its own subfamily intermediate between *Synaptomys*, *Myodes*, and *Arvicola*, having the external form of the first, the palate of the second, and the dentition (excluding its *sui generis* dental peculiarities) of the third. This is by no means an isolated case where a certain form is "synthetic", inasmuch as it combines the peculiarities of several forms of its own group, and is thus central so far as its own group is concerned, and yet is "peripheral" so far as another group is concerned; i. e., represents the inosculating point of its own with another group. It is through *Evotomys*, as a comprehensive type of *Arvicolinæ*, that *Murinæ* are related to all *Arvicolinæ*. We may surmise that *Evotomys* remains nearest an original type of *Glires*, from which both the *Murinæ* and *Arvicolinæ* of the present day have descended; and that, while *Synaptomys*, *Myodes*, and *Arvicola* have been successively differentiated from *Evotomys*, still this stands nearest the forking where the murine series branched off from the arvicoline.

A minute description of the teeth of *Evotomys* will be found under head of *A. "gapperi"*.

The species of this genus are few in number; but, in the absence of authentic skulls of some European and Asiatic animals that have been referred to it, we cannot undertake to say how many there be. The North American animals may be recognized at a glance among other *Arvicolinæ* by their prominent ears and tawny-red color, due to the mixture of orange in the ferruginous or chestnut that is a common tint with the other species. We have had the pleasure of introducing a species not hitherto known to inhabit North America; and in our further account we hope to prove our present belief, namely, that *Arvicola* or *Hypudæus rutilus* of authors (= *Mus rutilus*, Pallas) is a species of circumpolar distribution, which, south of a certain isothermal, has become differentiated into varieties known in North America as "gapperi", and in Europe as "rubidus" and "glareola".

## EVOTOMYS RUTILUS, (Pall.) Coues.

*Mus rutilus*, PALLAS, Nov. Sp. Quad. Glinum, 1778, 246, pl. xiv, B.

*Evotomys rutilus*, COUES, Proc. Acad. Nat. Sci. Phila. 1874, 187.

*Arvicola gapperi*, DALL, Alaska and its Resources, 1870, 577.

**HABITAT.**—Circumpolar regions of both hemispheres.

**DESCRIPTION.**—This animal is less than the average size of *Arvicola* proper, about equaling *Pitymys pinetorum* in dimensions, and in color it is so conspicuously different from any other of North America that the somewhat extended notice we shall give it is for the purpose mainly of settling its relationships to its own varieties, not of distinguishing it from other species.

With one exception, it has an external form indistinguishable from that of *Arvicola* generally. This exception is in the ears, which are always visible above the fur, even when, as in winter and in northernmost specimens, the pelage is longest and thickest. The ears are of ordinary shape, but differ from those of some species of neighboring sections in being very closely pilous, like a squirrel's, for instance, instead of rather loosely hirsute. The hairiness forms a slight even fringe around the margin, but below internally is almost wanting; the part that is covered by the general fur of the head being otherwise naked, so that the portion of the auricle that projects beyond the general pelage is the only part really furred. The antitragus is well developed; and just at its base there is a slender tuft of long hairs equaling, if they do not exceed, the whole ear in length.

Possibly the snout is a trifle less blunt than in some other *Arvicolines*; but the difference, if any, is not very obvious. The end of the muzzle is completely hairy, except the two little pads in which the nostrils open; beneath these, the hairs of the cleft upper lip fall like a moustache over the teeth, completely hiding the edges of the lips. The eye is of ordinary size, and in the usual situation relative to snout and ears. The whiskers are medium in number and length, equaling—some of the longer ones a little exceeding—the head. The fore feet are from little less than half to about three-fifths the hinder. They are softly and densely hairy above and along the sides, only the palmar tubercles and under surfaces of the annulated fingers being completely exposed. The 3d and 4th digits are of about equal lengths and longest; the 2d is much shorter; the 5th a little less than the 2d; the 1st obsolete. The furriness of the feet is much the same as that of the hands; the soles being hidden to the tubercles, and the sides of the toes fringed with

hair; and, in some specimens, especially in winter, the entire sole is covered with fur, although no hairs really grow on the tubercles. The 2d, 3d, and 4th toes are about equal in length, and longest; the 5th is only about half their length; the 1st still shorter; all bear ordinarily developed nails. On the whole, the furring of the feet of this animal is much heavier than that of *Arvicola* living in less rigorous climates, and is only surpassed in length and density by that of the Lemmings. The tail is similarly indicative of a hyperborean habitat, and merits special attention, since the difference in this member between true *rutilus* and its conspecifics of lower latitudes is the most conspicuous feature. If we call to mind the stumpy, heavily-furred, almost rabbit-like tail of a Lemming, and then lengthen it to half-way between this and the tail of more southern *Arvicola* generally, we shall have about hit the mark. Even including the unusually long pencil of hairs at the tip, the tail is barely or not twice as long as the sole, and it often falls much short of this proportion. It is remarkably thick, and hardly diminishes in caliber to the very tip, which is obtuse. It is densely hairy throughout, having no trace of scales or annuli; and the long, thick, terminal pencil averages fully a third of the length of the vertebral portion.

The size and relative proportions of this animal are sufficiently illustrated in the table below to render further notice here unnecessary.

The peculiar color of this, the type of the genus—and the shade is shared to a greater or less extent by all the forms of the genus with which we are acquainted—is almost of itself diagnostic. The middle lengthwise area of the upper parts, from the forehead, or even the snout, to the tail, are of a bright rusty-red, or brick-color, just as if a trace of orange, or even a touch of vermilion, were mixed with the rufous-brown that marks so many other Arvicolines. This rusty-red always has a few black longer hairs in it; sometimes these are so sparse that its uniformity is not perceptibly removed, but at others the very central dorsal line becomes a little blackish, especially over the haunches. The width of this dorsal area and its sharpness of distinction are very variable; sometimes the red is spread over the whole back, and washes imperceptibly into the color of the sides, and at other times it is narrow and pretty distinct. The color of the sides is luteous, like unbaked yellow clay, but is often grayish-yellow rather than yellowish-gray. Just as the back fades into the sides, so these wash out into the color of the belly, without much sharpness of definition, though the line of change is usually

perceptible. The under parts are dull white, much soiled, with a weak shade of the yellowish clay-color of the sides, and the ashy of the bases of the hairs is always more or less apparent. The luteous shade of the under parts is sometimes almost as strong as on the sides, especially across the abdomen. Between the thighs and arms, and under the throat, a whiter and ashier shade prevails. The tail is distinctly bicolor, but not very sharply so; the under surface is like the belly or rather yellower, the upper like the back or rather darker. There are no definite markings about the head; but a slight dusky area frequently observable about the eyes, and a sort of stripe of dusky along the nose, sometimes suggest a certain particoloration there. The upper surfaces of the hands and feet are nearly white.

We should not omit to add that the pelage is everywhere long, full, soft, and mollipilose, with but little admixture of lengthened bristly hairs, thus affording efficient protection from the rigors of the winter of high climates. There is a tangible difference in this regard in the more southern varieties.

We have great pleasure in adding this interesting animal to our fauna, our only previously-recorded form being the var. *gapperi*, and the *Mus rutilus* of Pallas being supposed to be confined to the north of Europe and Asia. Of the correctness of our identification there can be absolutely no question whatever. We have carefully compared our North American series with specimens from Lapland and Kamschatka, and they prove identical. All the differences supposed to mark the North American "*Hyp. dæus*" disappear in the Arctic series below given, being only applicable to the series from the Northern United States and adjoining regions; and they are, we hold, only indicative of a climatic differentiation. We challenge the proof that *Mus rutilus* is not a circumpolar species, which, south of a certain isothermal, has become modified into what is known in North America as "*Hypudæus gapperi*" and in Europe as "*H. glareola*" and "*H. rubidus*".

Professor Baird says, of the skulls of "*Hypudæus*" he examined, that that of *gapperi* "bears a very close resemblance to that of *Arvicola rutilus*; so close, indeed, that \* \* I am unable to indicate reliable characters to separate specimens from Massachusetts and Lapland". We are able to include *glareola* in the same statement, and to prove, by the following table of measurements, that there are no cranial or dental differences whatever in the three supposed species.

TABLE XXXVI.—Measurements of nine skulls of *A. RUTILUS*, "*gapperi*", and "*glareola*".

No.	Name and locality.	Length.	Height.	Zygomatic width.	Interorbital width.	Length of upper molar series.	Length of incisors.	Tip of under incisors to—			Length of under molar series.	Length of under incisors.
								Condyle.	Coronoid.	Descending process.		
1057	<i>rutilus</i> —Lapland .....	0.95	0.30	0.52	0.17	0.20	0.15	0.52	0.68	0.65	0.20	0.24
<sup>12</sup> / <sub>1057</sub>	.....do .....	0.30	0.49	0.18	0.19	0.14	.....	0.63	0.60	0.20	0.23	.....
<sup>12</sup> / <sub>1057</sub>	.....do .....	.....	.....	0.17	0.19	0.13	.....	0.64	0.62	0.21	0.22	.....
<sup>12</sup> / <sub>1057</sub>	.....do .....	0.96	0.30	0.54	0.19	0.22	0.16	0.66	0.65	0.23	0.24	.....
<sup>12</sup> / <sub>1057</sub>	<i>glareola</i> —Sweden .....	1.00	0.34	0.55	0.16	0.20	0.16	0.50	0.68	0.68	0.23	0.27
<sup>12</sup> / <sub>1057</sub>	<i>gapperi</i> —Lake Superior .....	0.97	0.34	0.53	0.18	0.21	0.17	0.51	0.65	0.68	0.23	0.27
<sup>12</sup> / <sub>1057</sub>	.....do .....	0.91	0.31	0.50	0.17	0.20	0.18	0.49	0.62	0.61	0.20	0.27
<sup>12</sup> / <sub>1057</sub>	<i>gapperi</i> —Massachusetts .....	0.92	0.31	0.51	0.17	0.20	0.17	0.48	0.60	0.61	0.22	0.26
<sup>12</sup> / <sub>1057</sub>	.....do .....	0.94	0.33	0.55	0.18	0.19	0.16	0.49	0.70	0.67	0.20	0.26

Thus it appears that the differences between the Lapland and Massachusetts skulls are no greater than those discrepancies that occur in either, and that all are largely within the limits of individual variation. A detailed account of the skull, especially as regards dentition, will be found under head of var. *gapperi*. We here tabulate our specimens of true *rutilus*, with measurements.\*

TABLE XXXVII.—Measurements of sixty-seven (and list of other) specimens of *EVOTOMYS RUTILUS* from Asia, Europe, and North America.

Number.	Sex.	Locality.	Collector.	Nose to—			Tail to—			Fore foot.	Hind foot.	Ear.	Remarks.
				Eye.	Ear.	Occiput.	Tail.	Vert.	Hairs.				
1468		Kamtschatka	Museum Berlin	0.46	0.90	1.00	3.40	1.00	1.30	0.37	0.70	0.40	Dry.
1970	♂	do	Museum St. Petersburg.	0.51	0.99		3.50	1.15	1.50	0.54	0.63	0.40	do.
404		Lapland	Kongl. Svensk Ak.				1.08	1.50	0.50	0.65			do.
405		do	do				3.60	1.00	1.30	0.34	0.65		do.
3027		Nelson R., H. I., T.	D. Gunn				3.50	1.10	1.40	0.36	0.70	0.41	do.
6991		Big Island	J. Reid				4.00	0.95	1.90	0.34	0.70		Dry; stretched.
8758	♀	Fort Good Hope	C. P. Gaudet				3.10	0.89	1.25	0.30	0.68		Dry.
6990		Fort Norman	N. Taylor				3.50	0.90	1.30		0.74		do.
5784		Fort Rae	L. Clarke				3.60	0.80	1.25	0.31	0.69		do.
5725		Arctic America	B. R. Ross									0.68	do.
5723		Fort Liard	W. L. Hardy				3.75	1.00	1.30	0.32	0.68	0.40	do.
4563		do	A. McKensie	0.95	3.00	1.00	1.25	0.31	0.68	0.39			do.
6917		La Pierre House	J. Fleiss				3.50	1.10	1.50	0.36	0.70	0.54	do.

\* About thirty other skins, collected by Esquimaux in the Anderson and Mackenzie River regions, are prepared so wretchedly as to afford no data of size of the body, while the feet and tail are as with the rest. They are therefore not introduced. Some of these skins measure upward of six inches in length, a striking instance of the elasticity of the skins of these small mammals.



Number.	Sex.	Locality.	Collector.	Nose to--			Tail to--		Fore foot		Hind foot.		Remarks.	
				Eyes.	Ears.	Occiput.	Tail.	Vert.	Hairs.	Fore foot.	Hind foot.	Ears.		
6919		La Pierre House	J. Flett					4.92	1.15	1.40	0.34	0.70	Dry; stretched.	
6918		do	do					4.00	1.10	1.50	0.33	0.70	do.	
7085		Fort Resolution	J. Lockhart.					3.00	1.90	1.50	0.33	0.70	Dry.	
7096		do	do					3.00	1.00	1.30		0.72	do.	
7097		do	do					3.00				0.70	do.	
7098		do	do					3.00	1.50	1.50		0.71	do.	
4562	♂	Fort Liard	R. Kennicott.	0.50	0.80	1.00	3.30	1.23	1.53	0.35	0.73	0.40	Fresh.	
4539	♀	Fort Simpson	do	0.50	0.88	1.00	3.23	1.08	1.30	0.33	0.70	0.40	do.	
4561	♂	do	do	0.50	0.95	1.05	3.50	1.35	1.65	0.40	0.75	0.38	do.	
7745		do	do	0.49	0.88	1.05	3.40	1.03	1.33	0.37	0.70	0.53	Alcohol.	
7747		do	do					15.05	1.05	3.20	1.10	1.45	0.36	do.
6892		200 miles S. W. of Yukon R.	do	0.51	0.96	1.02		0.90	1.25	0.33	0.74	0.45	Dry.	
6893		do	do							0.33	0.73	0.50	do.	
6891		do	do	0.53				0.87	1.30	0.34	0.75	0.41	do.	
6894		do	do					1.15	1.55	0.37		0.50	do.	
6895		do	do									0.66	do.	
6907		Porcupine River	do	0.47		0.97		1.10	1.50			0.75	do.	
6904		do	do					3.23	1.10	1.45	0.37	0.70	do.	
6911		do	do					1.10	1.50	0.33	0.72		do.	
6901		do	do					3.50	1.00	1.33	0.30	0.68	do.	
6909		do	do					1.06	1.56	0.31	0.70		do.	
6908		do	do					1.05	1.45	0.31	0.67		do.	
6903		do	do					0.90	1.30	0.34	0.72		do.	
6902		do	do					1.00	1.40	0.33	0.70		do.	
6906		do	do					0.50					do.	
6907		do	do					0.95	1.40	0.33	0.70		do.	
6904		do	do										do.	
6899		do	do					1.10	1.00	1.45	0.39	0.68	do.	
6900		do	do					3.00	1.00			0.69	do.	
6915		do	do					1.10	1.50	0.34	0.75		do.	
6915		do	do					0.93	1.40	0.33	0.73		do.	
6914		do	do					0.95	1.30	0.31	0.58		do.	
6912		do	do					1.10	1.50	0.35	0.74		do.	
6905		do	do					0.90	1.30	0.34	0.72		do.	
6913		do	do					0.95	1.35	0.35	0.75		do.	
6896		do	do					1.00	1.45	0.39	0.73		do.	
9091														
to		McKenzie's River	R. McFarlane										do.	
9106														
9117														
to		do	do										do.	
9119														
9129														
to		do	do										do.	
9130														
9016		Fort Anderson	do		0.40	0.90		3.00	0.90	1.30	0.34	0.75	do.	
9017		do	do					3.30	0.95	1.35	0.33	0.70	do.	
9018	♀	do	do		0.50	0.98		3.10	1.00	1.50	0.39	0.74	do.	
9019	♂	do	do					3.75	1.05	1.60	0.31	0.73	do.	
9090	♂	do	do					3.75	1.00	1.45	0.30	0.69	do.	
9024	♀	do	do										do.	
9106		do	do					0.90	1.35		0.70		do.	
9100		do	do										do.	
9160	♀	do	do					1.05	1.35		0.72		do.	
9171		do	do										do.	

TABLE XXXVII.—Measurements of sixty-seven (and list of other) specimens of *EVOTOMYS RUTILUS* from Asia, Europe, and North America—Continued.

Number.	Sex.	Locality.	Collector.	Nose to—				Tail to—				Remarks.
				Eye.	Ear.	Occiput.	Tail.	Vert.	Hair.	Fore foot.	Hind foot.	
9163	...	McKenzie's River .....	R. McFarlane.....	...	...	...	...	...	...	...	...	Dry.
8756	♂	do .....	do .....	...	...	...	3.40	1.00	1.50	...	0.75	do.
8306	...	do .....	do .....	...	...	...	3.10	0.95	1.35	0.30	0.74	Alcohol.
8397	...	do .....	do .....	...	...	...	3.40	0.85	1.90	0.30	0.75	do.
9400	...	do .....	do .....	...	...	...	...	...	...	0.70	0.49	do.
4699	♀	Anderson River.....	do .....	0.50	...	...	3.50	1.2	1.60	0.35	0.78	Dry.
4681	♂	do .....	do .....	...	...	...	3.50	1.10	1.25	0.31	0.70	do.
7599	...	do .....	do .....	0.50	0.85	1.10	3.10	1.00	1.40	0.35	0.70	Alcohol.
9983	...	Nulato, Alaska.....	W. H. Dall.....	0.47	1.00	1.20	3.70	1.30	1.70	0.30	0.80	do.
9994	♂	do .....	do .....	0.49	0.94	1.15	3.50	1.30	1.60	0.40	0.77	do.
9953	♂	do .....	do .....	0.45	0.90	1.10	3.11	1.20	1.50	0.30	0.70	do.
9996	...	do .....	do .....	0.46	0.85	1.00	3.20	1.20	1.55	0.34	0.75	do.
9987	♂	do .....	do .....	0.50	0.90	1.10	3.40	1.15	1.55	0.35	0.72	do.

Observations made just now regarding the identity of the measurements of Lapland and Massachusetts skulls may be here repeated respecting measurements of Asiatic, European, and American skins: there are discrepancies, but only those of individual variability.

The distance from nose to eye averages half an inch; from nose to ear, about nine-tenths; the length of the head about an inch. The average length of the body we cannot make out precisely, as all our specimens are dried skins, and many of them stretched or otherwise distorted. Doubtless the average derivable from the table, as the figures stand, is a little too high. We doubt that any one of the specimens exceeded 3.75 in life, and think that few touch this dimension, which we are inclined to fix as about the normal maximum; the average is probably just about 3.33, while the normal minimum of adults may be a trifle under 3.00. The tail-vertebræ run between 0.90 and 1.25, with an average of hard upon 1.10; the pencil of hairs at the end is the fullest and longest of any North American representative of the subfamily, a Lemming hardly excepted. It is rarely under a third of an inch, averages upward of four-tenths, and sometimes reaches the half-inch. The tail to end of hairs averages close upon 1.50. The palms are within an inappreciable fraction of a third of an inch, while the soles correspondingly bear upon 0.70, with two-thirds and three-fourths as apparently minima and maxima. The ears run between barely over a third to little more than half an inch, averaging nearer the latter dimension.

## EVOTOMYS RUTILUS GAPPERI, (Vig.) Coues.

## Red-backed Mouse.

- Arvicola gapperi*, VIGORS, Zool. Journ. v, 1830, 204, pl. 9 (Canada).—DEKAY, N. Y. Zool., 1, 1843, 91.—SCHLIZ, Synop. Mam. ii, 1845, 252.—ALLEN, Bull. Mus. Comp. Zool. i, 1869, 231.
- Arvicola (Hypudaeus) gapperi*, BAIRD, M. N. A. 1857, 518.
- Evotomys rutilus gapperi*, COUES, Proc. Acad. Nat. Sci. Phila. 1874, 187.
- Arvicola fulva*, AUD. & BACH., Journ. Acad. Nat. Sci. Phila. viii, 1842, pt. ii, 295 (name pre-occupied and afterward changed to "*dekayi*").—WAGNER, Wiegmann's Archiv, 1843, pt. ii, 53.
- Arvicola dekayi*, AUD. & BACH., Q. N. A. iii, 1854, 277 (same as their *fulva* of 1842), (exclude the synonym "*oneida* De Kay", which belongs to *Arvicola riparius*).

DIAGNOSIS.—*A. rutilo simillimus, sed staturâ paululum major, coloribus obscurioribus, caudâ, pedibus auriculisque longioribus.*

HABITAT.—The northern frontier of the United States, from Atlantic to Pacific, and an adjoining belt of British America; further north replaced by the true *rutilus*. Nova Scotia. South to Massachusetts.

The occurrence of the true *A. rutilus* in North America was not more unexpected to us than the relationship of *A. gapperi*, which we had always unquestioningly taken as a valid species, proved to be. The differences, as detailed by Baird (op. cit. 521), seemed perfectly satisfactory; but, with more extensive material than that writer enjoyed, we are enabled to make out a different state of the case. Our views would have received strong corroboration upon *à priori* considerations from the mere circumstance of finding the true *rutilus* in America; but, independently of this, we are prepared to present a chain of evidence that cannot be broken down, from direct comparison of specimens irrespective of locality.

The general tendency of animals that range from temperate to frigid regions, to shorten their members, or, as it were, withdraw peripheral parts from the cold, and to put on thicker, warmer covering, in higher latitudes, is a well-known law, of which the present case merely affords another example.

We have already seen the condition of the pelage, and the proportions of the tail, ears, and feet, in true *rutilus*, from high latitudes; and the present variety, with the same general characters as *rutilus*, differs in the length of its several members, and their amount of hairiness, as well as in the condition of the general pelage. The difference, however, is not abrupt, nor is it, in fact, even well marked, except in its extremes. The transition from typical *rutilus* to the extreme of southern *gapperi* is so gradual and insensible that there is no break in the series. This will be evident from the table given below, in which the various examples of *gapperi* differ as much among themselves as some of them do from true *rutilus*. Still, comparison of the

two tables gives an *average* difference between *gapperi* and true *rutilus* which is readily appreciable; and most specimens are sufficiently marked to enable us to assign them to one or the other form with much confidence. We have never seen a United States example that was not unmistakably *gapperi*, nor an Arctic one not as evidently true *rutilus*. But the two forms dovetail so nicely that they cannot possibly be specifically separated; and, moreover, we are unable to assign the geographical limits of either with greater precision than is given in the opening paragraph under the heading. Mr. Kennicott's Red River specimens appear to be *gapperi*, but stand hard against *rutilus*. The Fort Churchill animal, although so northern, is one of the longest-tailed of the whole series.

Regarding the name of this southern form, there is little or no question. As we have shown, the long-tailed and -footed forms extend a little north of the United States; Nova Scotian examples, for instance, are truly like those of the United States, and so are others from the Red River of the North. Gapper's animal was from Canada, and therefore quite within the known range of the southern form. In 1842, the United States style was renamed "fulvus" by Audubon and Bachman, probably in ignorance of Vigors's previous name *gapperi*; but, in 1854, these gentlemen, finding their name "fulvus" pre-occupied (by *Lemmus fulvus* Geoff., a French *Arvicola*), changed it to *dekayi*. They gave an excellent and unmistakable description, and only err in adducing "*A. oneida* DeKay" as a synonym, the last being one of the interminable designations of *Arvicola riparius*.

This animal is so much like *rutilus* that we can only characterize it in comparative terms. Possibly it ranges a trifle larger; but the difference is never very evident, and often none exists. In color, it runs a little darker, we believe; that is to say, the upper parts are more strongly chestnut rather than yellowish ferrugineous, lacking the "red" or "orange" shade that *rutilus* shows; the sides are not so luteous, being more yellowish-brown, as in *Arvicola riparius* for example, and underneath the fur is simply grayish-ashy-white, instead of having a strong clay-colored cast. Generally, the feet are less purely white; a difference in the length and thickness of the fur is noticeable. But the chief discrepancy lies in the relative and absolute length of the feet and tail, especially the latter. Without professing to draw an infallible dividing line, we may say that in true *rutilus* the tail (vertebræ) is as long as the head, and that in *gapperi* it is longer. In either case, it is, with the hairs, about twice as long as the sole; but then it must be remembered

that in *gapperi* the feet and tail are lengthened *pari passu*. There seems to be a positive difference in the shape of the tail, which in *gapperi*, besides being longer, is slimmer, or of less caliber, than in *rutilus*, and it tapers to a finer point. In *gapperi*, again, the hairiness of the tail is much less than in *rutilus*, the annuli being always visible, and the terminal pencil never equaling a fourth of the length of the member. There is a corresponding decrease in the hairiness of the feet; the soles of the Massachusetts specimens, even winter ones, showing a naked space behind the posterior tubercle.

We cannot agree with Professor Baird that *gapperi* "appears quite distinct from the *Hypudeus glareola* of Keyserling and Blasius". It is true that our material is insufficient to bring us to any conclusions to which we should wish to finally commit ourselves; but, for all that we can see, *rutilus* has in Europe undergone precisely correspondent modifications with climate, resulting in the so-called "*glareola*". Our samples purporting to be of this last are only two, Nos. 402 and 403, both from Sweden, and one of these is young and in poor condition, and therefore not eligible for comparison; but No. 402, taken in the depth of winter of 1847, seems to us in every respect identical with winter skins from Massachusetts and Lake Superior. Thus No. 402 and No. 910 (from Lake Superior) might have belonged to the same litter, for any difference that we can discover.

We feel justified in using substantially the same language respecting the so-called *Hypudeus rubidus* of Europe; that is, provided No. 2994, from Switzerland, labeled "*Myodes rubidus*", be really an example of that form. This, our only example purporting to be "*rubidus*", is a little smaller, perhaps, than average *gapperi* or "*glareola*", with length of tail and feet at a maximum, as was to have been expected from its very southern habitat; but we find nothing to raise a suspicion of its specific distinction.

However, in a memoir upon North American mammals, we need not go out of our way to discuss a question affecting those of other countries exclusively. We do not, therefore, pursue the subject; and in the same spirit we refrain from adducing any European names as synonyms of the American *gapperi*, or rather we retain the latter name as the designation of our animal, not making the change in nomenclature that might be necessary were *gapperi*, *glareola*, and *rubidus* combined.

A specimen of *gapperi* from Chilowk Lake, Washington Territory, collected in August by Dr. Kennerly, while attached to the Northwest Boundary Survey, enables us to extend the known range of the species materially.

TABLE XXXVIII.—Measurements of thirty-eight (and list of other) specimens of *EVOTOMYS RUTILUS* GAPPERI from the Northern States and adjoining British Provinces.

[illegible]

\* No. 9976 and the eight succeeding numbers are young, or otherwise ineligible for measurement.  
† 8357:—Mammæ, 8; 2 pairs pectoral; 2 pairs inguinal; the two sets widely separated.

The foregoing table is made up of measurements published by Baird in 1857, with those of twelve additional specimens. The dry measurements are, of course, only approximately correct, and, as far as the total length of body is concerned, are a little over the truth, from over-stuffing, as is certainly the case with No. 1092. Probably no one of them was in life over 4.00 at the outside, and the real average cannot be over 3.50, instead of 3.60, as the figures stand. No. 2872, which we have not seen, is most likely ungrown. These circumstances tend to bring the maxima and minima a little nearer together, say 4.00 and 2.75 for total length, &c.

On comparing this table with that of *A. rutilus*, it will be seen that the average size is greater; that the tail-vertebræ average about a third of an inch longer, and the tail with its hairs little if any longer, showing the great difference in the length of the terminal pencil; the foot is 0.72 instead of about 0.70 on an average. The tables also show that while *gapperi* touches figures that *rutilus* rarely reaches, and that the average of the latter is near the minimum of the former, especially as regards tail, feet, and ears, that nevertheless the intergradation is complete.

*Description of the skull and teeth of A. GAPPERI.*—Aside from the generic features given under head of *Evotomys*, the skull of *gapperi* does not differ very noticeably from that of *Arvicola* in general. It averages in length 0.95, by 0.52 in zygomatic breadth, or about as 100 to 55. The interorbital constriction is about as broad as the rostral portion of the skull. The molar series is one-fifth or barely more of the total length. The upper incisors protrude a little less, and the under a little more, than the length of the molar series. In the lower jaw, the distance from the tip of the incisors to the end of the hamular process equals or is even less than the distance from the same point to the back of the condyle. This is as in *Pitymys*, and not as in the *riparius* section of *Arvicola*, where the former measurement exceeds the latter. The height of the skull, measured from the last molar inclusive perpendicularly upward, is just about one-third of the length. The interparietal bone is acute-angled laterally; there is a little foveole on the frontal; the nasal branch of the premaxillary is not longer than the nasal bone, and neither extends back of the anterior root of the zygoma. The tympanic bullæ are very much inflated and papery; the foramen magnum is large and subcircular. The incisive palatal foramina are long and narrow; the anteorbital are as usual in the subfamily. In adult skulls, the muscular impressions are distinct, leaving a shield-shaped plateau on top of the skull.

As usual in *Arvicolinæ*, the upper incisors are broader than they are deep, ungrooved, and yellow on their faces. As in all *Arvicolinæ*, except *Myodes* and *Synaptomys*, the under incisors run past the last molar, and reach up the ramus half-way to the condyle itself.

The molar series are not quite parallel, diverging a little from before backward. Spite of their rootedness, in which they resemble the teeth of *Murinae*, they are essentially constructed upon the plan of *Arvicolinæ*, being truly prismatic, with acute salient and reëntrant angles, and flat crowns composed of triangles of dentine surrounded by enamel walls—these walls meeting in several instances along the middle line of the tooth, and isolating dentine islands, in other instances allowing contiguous dentine islands to become continuous. Details of the molar crowns are as follow:—

The front upper molar presents little or nothing characteristic, having the form constantly preserved throughout the subfamily. There is an anterior closed triangle or semilune, then an interior closed triangle, then an exterior one, then an interior one, then a postero-external one—five in all. The middle upper molar is the same essentially, but with only four alternating triangles, of which the first after the anterior one is external, the second internal, the last postero-external. This is much as in the *Pedomys* and *Pitymys* section of *Arvicola*, and not as in the *riparius* section, where the last triangle develops a snag or spur from its inner face, making five in all, two of them internal. The back upper molar is the most peculiar and characteristic of all; indeed, it seems to be the case throughout *Arvicolinæ* that this tooth is diagnostic of the genera and subgenera; the sculpture of its crown certainly differs more than that of any other tooth. In the present case, the tooth is remarkable, first, for being absolutely *longer* antero-posteriorly than either of the other upper ones, which is not the case in *Arvicola*. In general, it comes nearest to the *riparius* type of *Arvicola*, having really the posterior crescentic loop and two distinct external triangles; so characteristic of *riparius* (instead of a simple posterior trefoil and one exterior triangle, as in *Pedomys* and *Pitymys* and *Chilotus*); but the details are even more complicated than in *riparius*. We have, first, the anterior loop quite across the tooth in front, then comes the first exterior triangle, then the first interior triangle; then all the rest is the plication of the immense posterior crescent, thus: the crescent has its back, which is long and nearly straight, to the outside of the tooth, but it throws off a spur anteriorly, forming the second exterior triangle,



which may be quite closed, or its area confluent with the general island of the crescent; behind, the crescent loops broadly, forming the end of the tooth, then throws out a spur on the postero-internal corner of the tooth, then in front of this is thrown into a large loop, which makes the second interior triangle, not closed, however, but continuous with the general area of the crescent. Thus there are in all, on the back upper molar, three exterior saliencies and four interior saliencies. The precise details of this tooth vary a little with individuals, but the pattern, as just described, we have never found effaced or even obscure; it is, therefore, highly diagnostic.

The molar crowns of *Arvicola* in general appear to have central enamel, or interior folds and ridges separated from the general enamel wall that enfolds the teeth, but this appearance is deceptive; there is but the single enveloping sheet of enamel around the whole tooth, which is so deeply indented or folded in at the reëntrant angles of the several prisms that the enamel sheet of opposite sides meets and fuses along a central line, often no wider than a single sheet of enamel, producing the appearance just mentioned. Now, in *Erotomys*, the enamel of opposite sides, in the upper jaw, meets at various places, but the fusion is not complete; either the two sheets are apparent where they touch each other, or else the imperfect fusion results in a wall the composition of which is evident by its being broader or thicker than a single sheet of enamel is anywhere. And in the under series, which we now come to examine, the enamel walls are still more distinct, revealing their true relations; they never quite fuse, and, even where they press upon each other most closely, we can discern two distinct folds, and thus trace the single enveloping sheet of enamel, in and out, in its various plications, all around the tooth.

The posterior lower molar affords nothing diagnostic, being, as in *Arvicola*, composed simply of an anterior, a middle, and a posterior spherical triangle, each one of these reaching quite across the tooth, and thus lying directly one after the other; but a singular thing is, that the middle lower molar copies the same pattern. In our *Arvicola* proper, this middle lower molar has an anterior triangle, succeeded by alternating lateral triangles; but in this genus the lateral triangles are opposite instead of alternate, which fact, together with the lack of a median lengthwise line of enamel, throws the two lateral ones into one that reaches quite across the tooth. It is surprising, in this case, with essentially the same pattern, such a little variation as this

produces a tooth that *looks* radically different in sculpture. The front lower molar carries the same general plan of *oppositeness* instead of alternation of the lateral triangles, which, with the distinctly double condition of the indentated angles of enamel, where these meet along the middle, tends to throw, and *almost* succeeds in throwing, the lateral triangles that occur in *Arvicola* into larger triangles, reaching quite across the tooth. Thus, from behind forward, there is first one perfect triangular loop reaching across the tooth; next, there are an external and an internal angle opposite each other, inclosing a lozenge that reaches across the tooth; next, there are an internal and an external angle, not quite opposite each other, and therefore forming two *nearly* separated lateral triangles, generally not completely closed in, however, but more or less continuous with the area of the large anterior trefoil that finishes the tooth in front.

#### GENUS ARVICOLA, Lacépède.

- < *Mus*, LINNÆUS, Syst. Nat. i, 1766, and most early authors.  
 < *Murex cunicularii*, PALLAS, N. Sp. Gliirum, 1773, 77.  
 < *Lemmus*, LINCK; FISCHER, et al.  
 < *Myodes*, PALLAS, Zoog. R.-A. i, 1811, 172. Not *Myodes* of Selys-Longchamps, 1839, which = *Hypudæus*, Keyserling and Blasius.  
 < "*Arvicola*, LACÉPÈDE, Tableau, 1803" (fide Agassiz), and most late authors. Includes *amphibius* and *arvalis*.  
 < *Hypudæus*, ILLIGER, Prod. 1811. Not of Keyserling and Blasius, nor of Baird. Includes *Mus lemmus*, *amphibius*, and *arvalis*.  
 > *Mynomes*, RAPINESQUE, Am. Monthly Mag. ii, 1817, 45. Type, *M. pratensis* = Wilson's Meadow-mouse, = *Arvicola pennsylvanica* Ord.  
 > *Psammomys*, LECONTE, Ann. Lyc. Nat. Hist. N. Y. 1820, 132 (*pinetorum*). Not of Ræppel.  
 > *Pitymys*, McMURTRIE, Am. ed. Cuv. R. A. i, 1:31, 434. Type, *A. pinetorum*, LeC.  
 > *Hemiotomys*, SELYS-LONGCHAMPS, Études de Microm. 1839 85 (includes *amphibius*, *terrestris*, &c.).  
 > *Microtus*, SELYS-LONGCHAMPS, op. cit. 1839, 85.  
 > *Pinomys*, LESSON, Nouv. Tab. R. A. 1842, 12 (*pinetorum*).  
 > *Hemiotomys*, BAIRD, M. N. A. 1857, 515. Type, *Arvicola riparius* Ord.  
 > *Podomys*, BAIRD, op. cit. 517. Type, *Arvicola austerus* LeC.  
 > *Chilotus*, BAIRD, op. cit. 516. Type, *Arvicola oregoni* Bach.

The foregoing synonymical list of itself indicates the limits we wish to set to *Arvicola*. All the earlier names, *Mus*, *Lemmus*, *Myodes*, *Arvicola* Lacép., and *Hypudæus* Ill., marked <, were of wider applicability than *Arvicola*, as we define it, is; for they all (unless *Arvicola* Lacép. be an exception) included the Lemmings, and made no distinction of the rooted-molar species of what Keyserling and Blasius afterward called *Hypudæus*, and what we now call *Evotomys*. The many later names, marked >, are of less enlarged application than our *Arvicola*, being simply based upon particular species of the genus; most of them will stand as convenient subgeneric terms for the

various sections of the genus that it is quite worth while to recognize. The names *Psammomys* LeC. (*nec* Rüpp.), *Pitymys* McMurt., and *Pinemys* Less. are mere synonyms, all having been based on the same animal (*pinetorum*), and two of them being simply amends for LeConte's mistake in taking *Psammomys* Rüpp. for his *Arvicola pinetorum*. "*Microtus*" Selys. appears to be about the same thing as *Pitymys*. *Hemiotomys* Selys. (*nec* Baird) goes to the European *amphibius*. *Myonomes* Raf. and *Pedomys* and *Chilotus* Baird are tenable subgeneric names for particular American groups. Doubtless there are some other generic or subgeneric names that have not come to our notice.

In proceeding now to define *Arvicola*, we may premise that our diagnosis of the genus will simply be equivalent to such restriction of the characters of the subfamily *Arvicolinae* as will exclude the Lemmings, the remarkable *Synaptomys* of Baird, and the rooted-molar group (*Evotomys* nob. = *Hypudæus* Keys. Blas. Bd. *nec* Ill.). Some of the more boreal *Arvicole* do indeed closely approximate to the Lemmings in the shortness of their ears, tail, and feet, and in the mollipilose pelage; but the radical differences in dentition are never, so far as we know, obscured. It may be that there are some species of *Arvicolinae* that require generic separation from *Arvicola* besides those just mentioned, but none such have come to our knowledge.

Some of the characters we are about to give are rather those of the subfamily than of the genus; but the particular combination, as expressed in the whole paragraph, is generally diagnostic.

GEN. CHARS.—CLOWNS of the (§-3, rootless, perennial, prismatic) molars plane, divided into several closed islands of dentine by folds of the surrounding sheet of enamel that meet from opposite sides and fuse along the median line (cf. *Evotomys*); the saliencies and reëntrances of the alternating prisms strong and sharp, equally so on both inner and outer sides of the molar series, the profile of which is therefore equally serrate on both sides (cf. *Myodes*, *Synaptomys*). Anterior upper molar of 5 prisms,—1 anterior, 2 interior, 2 exterior. Middle upper molar of 4 (or 5) prisms,—1 anterior, 1 interior, 2 exterior (the last sometimes giving off a supplementary postero-interior one). Posterior upper molar of 4 to 7 prisms, of which the first is always anterior and transverse, the last a variable treffle (C, G, U, V, Y, &c., in shape, according to subgenus or species), and the intermediate ones lateral and alternating. All upper molars subequal in length and breadth (cf. *Myodes*, *Synap-*

*tomys*). Anterior lower molar of 5 to 8 prisms, of which the anterior forms an irregular trefle, the posterior a transverse loop, the intermediate forming lateral, alternating, closed triangles; this molar nearly as long as the other two together. Middle lower molar of 4 to 5 prisms, of which the last forms a transverse loop, the rest forming alternating lateral triangles (cf. *Evotomys*). Posterior lower molar abruptly narrower than the rest, never of more than 3 prisms (cf. *Synaptomys*, *Myodes*) seriatim, each making a transverse loop (no lateral or alternating triangles). Upper incisors plane (cf. *Synaptomys*). Under incisor roots running past the last molar, and thence up the back of the condylar process, forming a thickening of the ramus, or a strong ridge that subsides at the notch between condyle and descending process (cf. *Synaptomys*, *Myodes*). Skull solid, massive, its zygomatic diameter slightly exceeding its length; interorbital constriction abrupt; temporals angularly encroaching on orbits. Zygomatic not dipping to level of palate, slightly expanded. Posterior termination of bony palate never a single, abrupt, transverse shelf (cf. *Evotomys*, *Myodes*, *Synaptomys*), but palate ending between ultimate molars by dipping to a conspicuous fossa on either side, between which is the narrow median fissure of the posterior nares; said fossæ leading directly out to the pterygoids. Incisive foramina short and close, attaining neither incisors nor molars, but midway between both. Nasals anteriorly subtruncate opposite incisive alveoli; posteriorly subequal or equal to nasal branches of maxillary, which reach nearly or quite to orbits. Coronoid process rising as high as the condyle (cf. *Evotomys*). Size medium for the subfamily; form stout; members short, but none of them rudimentary; neck indistinguishable; head broad, with convex forehead; muzzle obtuse; lip fairly cleft, hirsute; eyes small, midway between ears and snout; muzzle furry, except nasal papillæ; whiskers 5-seriate. Ears well developed (cf. *Myodes*), but never noticeably overtopping the fur, orbicular, more or less hirsute both sides, with valvular antitragus. Fore feet  $\frac{1}{2}$ — $\frac{3}{4}$  the hind feet, with mostly naked tuberculate palms, 4-digitate; thumb obsolete, with abortive, obtuse, flattened, sessile nail; fingers unguiculate, inferiorly scutellate. Hind feet with soles neither entirely naked nor entirely furry, 5-6-tuberculate, the posterior tubercle long, 5-digitate; three middle toes longest and subequal, 5th and 1st successively much shorter. Tail terete, always hairy enough to obscure or conceal its annuli, and with terminal pencil, sometimes densely hirsute; always longer than the sole, generally exceeding the head, but ranging in length from about

as long as head to nearly half as long as trunk. Pelage thick, soft, of ordinary fur, interspersed dorsally with longer bristly hairs; the fur at the roots uniformly plumbeous, colored only at the tips; general colors subdued, the shades diffuse, rarely with distinct parti-coloration, but under parts ordinarily lighter than upper, and tail bicolor from sharing the respective shades.

The North American species fall naturally into four groups, as originally pointed out by Professor Baird. These groups may be thus conveniently analyzed:—

- (a) Back upper molar with 2 external triangles and a posterior crescent ..... *Myonomes*.  
     1 external triangle and a posterior trefoil (b).
- (b) Front lower molar with 3 internal and 2 or 3 external closed triangles ..... *Chilotus*.  
     2 internal and 1 external closed triangle (c).
- (c) Fore claws not larger than hind claws ..... *Pedomys*.  
     obviously larger than hind claws ..... *Pitymys*.

There are no tangible differences in the skull and teeth between *Pedomys* and *Pitymys*; nevertheless, the external peculiarities of *Pitymys* are greater than those of either of the other forms. *Chilotus*, in general external characters, is so like both *Myonomes* and *Pedomys* that we cannot distinguish them, except by the peculiar construction of the ear. It shares the posterior trefoil of the back upper molar with *Pedomys* and *Pitymys*, but shares the greater number of lateral closed triangles of the front lower molar of *Myonomes*. *Myonomes*, again, is not separated from *Pedomys* by any external character, but by its posterior crescent and two external lateral triangles of the back upper molar. So, combining dental and external characters, we may draw up the following antithetical diagnoses, making combinations perfectly tangible and satisfactory:—

- A.—*MYONOMES*. Back upper molar with 2 external triangles and a posterior crescent. Middle upper molar with 2 internal triangles. Front lower molar with 3 internal and 2 or 3 external lateral triangles. Ear unrimmed in front. Sole 6-tuberculate. Fore claws not longer than hinder ones. Tail about  $\frac{1}{3}$  the head and body, or more. Pelage ordinary. Of maximum and medium size.

B.—*CHILLOTUS*. Back upper molar with 1 external triangle and a posterior trefoil. Middle upper molar with 1 internal triangle. Front lower molar with 3 internal and 2 or 3 external triangles. Ear with a rim in front of the meatus, owing to meeting there of the anterior and posterior roots of the auricle. Sole 5-tuberculate (?). Fore claws not larger than hinder ones. Tail about  $\frac{1}{3}$  the head and body. Pelage ordinary. Of minimum size.

C.—*PEDOMYS*. Back upper molar with 1 external triangle and a posterior trefoil. Middle upper molar with 1 internal triangle. Front lower molar with 2 internal and 1 external triangle. Ear unrimmed. Sole 5-tuberculate. Fore claws not larger than hinder ones. Tail about  $\frac{1}{3}$  the head and body, or a little less. Pelage ordinary. Of medium size.

D.—*PITYMYS*. Back upper molar with 1 external triangle and a posterior trefoil. Middle upper molar with 1 internal triangle. Front lower molar with 2 internal and 1 external triangle. Ear unrimmed. Sole 5-tuberculate. Fore claws larger than hind ones. Tail about  $\frac{1}{4}$  the head and body, or less. Pelage dense, mole-like. Of small size.

#### SUBGENUS MYONOMES, Rafinesque.

< *Arvicola* of American writers.

= *Arvicola A.*, *Hemiotomys*, BAIRD, M. N. A. 1857, 515 (type, *Arvicola riparius* ORD). Not of SELYS-LONG-CHAMPS, whose type is the European *Arvicola amphibius*.

= *Mynomes*,\* RAFINESQUE, Am. Monthly Mag. ii, 1817, 45 (type, *Mynomes pratensis* RAFINESQUE, which is based on Wilson's Meadow-Mouse, Am. Orn. vi, pl. 50, f. 3, and is therefore = *Arvicola pennsylvanica* ORD and auct.).

= *Myonomes*, COUES, Proc. Acad. Nat. Sci. Phila. 1874, 180.

CHARS.—Posterior superior molar with an anterior loop, an internal closed triangle, two external closed triangles, and a posterior crescent. Anterior inferior molar with a posterior loop, an anterior trefoil, three lateral internal closed triangles, and two (or three†) lateral external closed triangles. Middle superior molar with a supplementary postero-internal triangle. (Other dental and cranial characters as in *Arvicola* at large.) Ears about  $\frac{1}{2}$  the fur, rounded, hirsute, with well-developed valvular antitragus; no peculiar construction of the concha. Tail exceeding the head in length (about one-third as long as head and body), fairly hirsute and with terminal pencil,

\* The original orthography is *Mynomes*. I do not know what, if any, meaning attaches to this word, but suppose it to be compounded with *myx*, so that it should be spelled *Myxonomes*, if not further altered into *Myonomus*.

† When there are three, the third results from change of the outer leaflet of the anterior trefoil into a triangle.

bicolor. Feet moderate; the fore about three-fifths as long as the hinder; fore claws not larger than hind ones.

This subgenus is fully illustrated in our article on its type, *Myonomes riparius*, where will be found an extended account of the dentition. Above we only give the diagnostic characters and their more prominent collaterals. The section is especially characteristic of North America, not being, perhaps, exactly matched in Europe or Asia; it embraces the greatest number of American species of the genus, among them the most widely-distributed one of all, and includes, likewise, the largest of all; while none of them are so small as our species of *Chilotus*, *Pitymys*, or *Evotomys*.

It here becomes necessary to explain the synonymy above adduced, and show cause for adopting the name *Myonomes* for the subgenus.

In the first and only subdivision of the American species of *Arvicola* which has, to my knowledge, been attempted, and which was so satisfactorily accomplished in 1857 by Professor Baird, the term *Hemiotomys* was adopted for this section. Professor Baird is, however, careful to add that this name was constructed by Selys-Longchamps to accommodate the European *amphibius*, *terrestris*, &c., the skull of which is more like *Pedomys austerus*; and this is exactly so. Now, the very first and most essential character of *Arvicola riparius*, as compared with *Chilotus oregoni*, *Pedomys austerus*, and *Pitymys pinetorum*, is the remarkable posterior crescentic or C- or G-shaped loop on the back upper molar, which is unique among American species of *Arvicola proper*, though again found in another genus (*Evotomys*). This particular feature is not seen in *Arvicola amphibius*, where the posterior upper molar has but one external and one internal lateral closed triangle, and then a posterior trefoil almost exactly as in *Pedomys austerus*. The inapplicability, therefore, of the name *Hemiotomys* to this section is evident; for to apply it here, is to ignore, by implication at any rate, the chief character of the section. If it is to be applied to any American section, it certainly ought to be given to that one of which *A. austerus* is typical, and thus be made to supplant *Pedomys*.

After coming to this conclusion, our first care, of course, was to see what European or Asiatic species our *A. riparius* did agree with in this particular pattern of the last upper molar. Among the limited number of skulls at our command, in addition to *A. amphibius*, we find as follows:—A Lapland skull, labeled "*ratticeps*" (No. 1056), has on the back upper molar an anterior loop,

two exterior closed triangles, *two* interior closed triangles, and a small sub-circular posterior trefoil, all of which makes a very different pattern from that presented by *A. riparius*. Another skull, from Siberia, labeled "*obscurus*" (No. 3226), shows an anterior loop, *three* external closed triangles, two internal closed triangles, and a posterior trefoil that is almost a short, very concavo-convex crescent by the depth of the notch of its inner leaflet. This is nearer to *A. riparius*, but not exactly it, as there is an additional interior closed triangle, and the crescent is not quite a crescent. A close approach, however, is made by No. 3228, labeled "*decoriorum?* or *æconomus?*" from Siberia; and in another, No. 2026, labeled "*agrestis*", from Sweden, the peculiar pattern of *riparius* is exactly reproduced. Upon dental characters alone, therefore, we would take as the name for our *riparius* any special genus that has been proposed upon either of these last-named species. The external characters, however, of *riparius*, do not agree with those short-tailed forms of boreal Europe and Asia, such as *agrestis*,\* *æconomus*, &c., but are very nearly as in "*ratticeps*". We, therefore, think it probable, as we said above, that the section for which we adopt the name *Myonomes* is not exactly represented in Europe, and consequently less confusion can ensue if we reject for the species not only *Hemiotomys*, but any other generic name that may have been based upon an Old World form. All the subgeneric or even "generic" divisions that we know of in the genus *Arvicola* are (with the single exception of the strongly-marked *Hypudæus* of Keyserling and Blasius and of Baird, equal to our *Evotomys*) so trivial as to be, in fact, but slightly superspecific designations, only worthy of being retained on the score of *usefulness*; for it is practically a convenient thing, in so difficult a genus as *Arvicola*, to strike

\* If the Central and Southern European specimens of "*arvalis*" and the northern ones of "*agrestis*" be correctly labeled, there appears to be some mistake in what Professor Baird says (*l. c.* 513), in speaking of the species of his section *Hypudæus*. "*Arvicola arvalis* of Southern Europe," he says, "and *Arvicola agrestis* of Northern Europe, supposed to be identical with the *A. arvalis* of authors, fall legitimately in the other genus" [*i. e.*, in *Arvicola* proper instead of in *Hypudæus*]. But all our skins marked "*arvalis*" have the prominent ears, &c., of "*Hypudæus*", and their skulls have the peculiar palatal structure of "*Hypudæus*", and their molar teeth are rooted, with crowns exactly as in other "*Hypudæi*". They certainly are *Hypudæus* (*Evotomys*), and must be ranged else alongside *E. rutilus*, *E. rubidus*, *E. glareola*, and *E. gapperi*. On the other hand, those skins marked "*agrestis*" have the hidden ears and short tail and other external characters, and the ordinary bifossate palatal structure, of *Arvicola* proper, to say nothing of their rootless molars, with crowns fashioned nearly as in *riparius*. So far, then, are our specimens from being specifically identical, that they are not even congeneric. We do not know how it may be with the "*arvalis* of authors", not having looked up the bibliography of the species; but, certainly, the "*arvalis*" before us is not as Professor Baird supposed.

On a subsequent page (516), however, Professor Baird correctly says that "*A. agrestis* from Sweden, in the character of its skull and teeth, belongs strictly to the group having *A. riparius* for the type". So the mistake seems to be simply in confusing "*arvalis*" with *agrestis*.



as many dividing lines as can be drawn between individual species and little groups of conspecifics. On this consideration, we have no scruple in drawing up the characters of *Myonomes* so stringently that all the European and Asiatic forms shall be excluded if possible.

Though we adopt the term "*Myonomes*" for what Professor Baird called *Hemiotomys*, we do not suppose that Rafinesque had any idea what he was about when he invented it. But there stands the name "*Mynomes pratensis*", based upon Wilson's Meadow Mouse, afterward *Arvicola pennsylvanica* of Ord, which is also *Arvicola riparius* of Ord. We do not see how the name can be rejected, seeing that his type—a now well-known species—is mentioned; and, after all, it is perhaps just as well that he did not try to explain what he meant.

### ARVICOLA (MYONOMES) RIPARIUS, Ord.

#### Common American Meadow Mouse.

*Campagnol or Meadow Mouse of Pennsylvania*, WARDEN, "DESCR. U. S. v. 625."

*Meadow Mouse*, WILSON, Am. Orn. vi, pl. 50, f. 3.

*Myonomes pratensis*, RAFINESQUE, Am. Monthly Mag. ii, 1817, 45.

*Arvicola pennsylvanica*,\* ORD, Guthrie's Geog. 2d Am. ed. ii, 1815, 292 (based on Wilson, l. c.).—HARLAN, Fn. Amer. 1825, 144 (in part. Quotes Ord, l. c., and describes *pinctorum*).—WAGNER, Suppl. Schreb. viii, 588.—SCHINZ, Synopsis, ii, 1845, 247.—AUD. & BACH., Q. N. A. i, 1849, 341, pl. xlv. f. —.—LECONTE, Proc. Acad. Nat. Sci. Phila. vi, 1853, 407.

*Arvicola palustris*, HARLAN, Fn. Amer. 1825, 136; Med. & Phys. Researches, 1835, 47.

*Arvicola riparius*, ORD, Journ. Acad. Nat. Sci. Phila. iv, pt. ii, 1825, 305 (Philadelphia), (not of Richardson?).—DEKAY, N. Y. Zool. i, 1842, 84, pl. xxii, f. 2 (young?).—AUD. & BACH., Q. N. A. iii, 1854, 392 (not figured. In text under "*montana*").—LECONTE, Proc. Acad. Nat. Sci. Phila. vi, 1853, 406.—BAIRD, M. N. A. 1857, 522 (Eastern United States).—GODMAN, Amer. Nat. Hist. 3d ed. 1860, i, 301.—ALLEN, Mamm. Mass., Bull. Mus. Comp. Zool. No. 8, 231.—And of late authors generally.

*Arvicola (Myonomes) riparius*, COUES, Proc. Acad. Nat. Sci. Phila. 1874, 189.—COUES & YARROW, Zool. Expl. W. 100th Merid. 1876, —.

*Arvicola riparius longipilis*, KENNICOTT, Agric. Rep. U. S. Patent Office for 1856-1856, 304 (specimens in heavy winter pelage from West Northfield, Ill.).—BAIRD, M. N. A. 1857, 524 (in text; same as Kennicott's).

*Hypudaeus riparius*, MAXIMILIAN, Arch. Naturg. xviii, 1862; Verz. N.-A. Säug. 1862, 174.

*Arvicola xanthognatha*, HARLAN, Fn. Amer. 1825, 136.—GODMAN, Amer. Nat. Hist. ii, 1826, 65; and 3d ed. 1860, i, 290 (not of Leach and Richardson).—SAY, Long's Exped. R. Mts. i, 1823, 360.—DEKAY, N. Y. Zool. i, 1842, 80.—LINSLEY, Am. Journ. Sci. xliii, 1842, 350.—†† SABINE, App. Franklin's Journ. 1825, 660.

\* This should stand, in strictness, as the specific name, with which Ord antedates Rafinesque. Since, however, the name is simply based, without sufficient description, upon a scarcely recognizable figure incidentally introduced in an ornithological work, I have preferred to adopt the same author's properly-characterized term *riparius*, though subsequent in point of date. Though I am aware that this course is, technically, indefensible, such slight latitude of choice stands to common sense, and infringes upon no author's rights, as Ord's earlier term cuts Rafinesque out of his.

† Doubtful. I have not been able to look up this reference; but Richardson says (F. B.-A. i, 122), "The description quoted by Sabine \* \* \* under title of *A. xanthognatha* does not belong to this animal, but to a much smaller species, which I have referred to the *A. pennsylvanica* of Ord."

- Arvicola albifuscus*, EMMONS, Rep. Quad. Mass. 1840, 60 (Massachusetts; partial albino).—DEKAY, N. Y. Zool. i, 1842, 89 (same as Emons's).
- Arvicola hirsutus*, EMMONS, Rep. Quad. Mass. 1840, 60.—DEKAY, N. Y. Fn. i, 1842, 86 (same as Emons's).
- Arvicola nasuta*, BACHMAN, Journ. Acad. Nat. Sci. Phila. viii, pt. ii, 1842, 296 (Massachusetts).—AUD. & BACH., Q. N. A. iii, 1853, 211, pl. clxiv, f. 2 (Massachusetts, New York, and Michigan).—LECONTE, Proc. Acad. Nat. Sci. Phila. vi, 1853, 407 (quotes "Wiegmann's Archiv, 1843, 52, and Schinz, 251").
- Arvicola oueida*, DEKAY, N. Y. Zool. i, 1842, 88, pl. xxiv, f. 1 (young; New York).—LECONTE, Proc. Acad. Nat. Sci. Phila. viii, 1853, 406 (same as DeKay's).
- Arvicola rufescens*, DEKAY, N. Y. Zool. i, 1842, 85, pl. xxii, f. 1 (Northern New York).
- Arvicola occidentalis*, PRALE, Mamm. U. S. Expl. Exped. 1848, 45 (Puget's Sound).—LECONTE, Proc. Acad. Nat. Sci. Phila. vi, 1853, 408 (same as Peale's).—AUD. & BACH., Q. N. A. iii, 1854, 294 (same as Peale's).—BAIRD, M. N. A. 1857, 534 (Peale's type described).
- Arvicola californica*, PEALE, Mamm. U. S. Expl. Exped. 1848, 46 (California).—LECONTE, Proc. Acad. Nat. Sci. Phila. vi, 1853, 408 (same as Peale's).—AUD. & BACH., Q. N. A. iii, 1854, 293 (same as Peale's).—BAIRD, M. N. A. 1857, 532 (Peale's type).
- Arvicola montana*, PEALE, Mamm. U. S. Expl. Exped. 1848, 44 (Mount Shasta, Cal.).—AUD. & BACH., Q. N. A. iii, 1854, 302 (same as Peale's).—BAIRD, M. N. A. 1857, 528 (California and Nebraska).—NEWBERRY, P. R. R. Rep. vi, 1857, Zool. 61.
- Arvicola edax*, LECONTE, Proc. Acad. Nat. Sci. Phila. vi, 1853, 405 (California).—AUD. & BACH., Q. N. A. 1854, iii, 270, pl. 154, f. 2 (taken from LeConte's type, and description compiled from LeConte).—BAIRD, M. N. A. 1857, 531 (description from LeConte's type).
- Arvicola borealis*, LECONTE, Proc. Acad. Nat. Sci. Phila. vi, 1853, 407, excl. synonym. (not of Richardson, &c. The species is based upon specimens from Rhode Island now in Mus. Smiths.).
- Arvicola townshidi*, BAIRD, M. N. A. 1857, 529, in text (name suggested from some supposed dental peculiarities of No. 1354, Mus. Smiths., from Monterey, Cal.).
- Arvicola longirostris*, BAIRD, M. N. A. 1857, 530 (based on supposed cranial peculiarities of No. 1355, Mus. Smiths., from California).—NEWBERRY, P. R. R. Rep. vi, 1857, Zool. 61.
- Arvicola modesta*, BAIRD, M. N. A. 1857, 535 (based on No. 1356, from Rocky Mountains; very young).
- Arvicola rufidorsum*, BAIRD, M. N. A. 1857, 526 (Holmes' Hole, Mass.; a very red specimen).
- Arvicola breveri*, BAIRD, M. N. A. 1857, 525 (bleached breed from Muskeget Island, Mass.).

**SKULL.**—The cranium of *Arvicola riparius* has not a single specifically diagnostic feature; all its characters are subgeneric, shared by *xanthognathus*, and by the various geographical strains more or less deviating in external characters from ordinary *riparius* of the United States. It averages, of course, smaller than that of *xanthognathus* or even of var. *townsendi*; but the minimum of both of these is within the average of *riparius*. Our table of measurements indicates both size and shape so perfectly that these points need not detain us here. The skull is not satisfactorily distinguishable, dentition aside, from that of *Pedomys*; for the difference in the length of the nasal branches of the intermaxillaries, given by Baird, does not always hold. From *Pitymys*, it may generally be known (dentition aside) by being larger and not quite so wide for its length (as 0.59 to 1.00, instead of 0.62 to 1.00, as in *Pitymys*). It averages much larger than that of *Chilotus oregoni*.

The dentition, likewise, offers nothing specifically diagnostic; all the species and varieties of the subgenus having the same pattern of the molar crowns. The present opportunity, however, is taken to fully describe the

teeth. The peculiarity of the back upper molar is not shared by any other North American section of *Arvicola*, though re-occurring in *Evotomys*.

The back lower molar consists of three prisms, the crowns of which form three nearly transverse spherical triangles, with their greatest convexity posterior; the inclosed dentine islets reach across the tooth (*i. e.*, there is no median line of enamel dividing off lateral triangles on either side, as is the case with all the other teeth; though sometimes, when the middle islet is very sharp-angled and a little oblique, it gives rise to a partial enamel-line, abutting against the wall of the back islet). As elsewhere throughout the genus *Arvicola*, the tooth is abruptly narrower than the antecedent one.

The middle lower molar has a posterior transverse crescentic ellipse, or spherical triangle, with its greatest convexity backward, its dentine islet reaching across the tooth. The rest of the tooth is of four alternating lateral closed triangles: the first internal, the second external, the third internal, the fourth or front one antero-external. Thus there are in all three saliencies on each side and two reëntrances on each side (*three* internal reëntrances, if a nick between the antero-external and next internal triangle be counted). The median zigzag of enamel effects perfect closure of all these triangles, starting from the front of the back loop forward and inward to form the base of the next lateral triangle, then shooting forward and outward, then forward and inward, then forward and outward. This tooth is much shorter and a little narrower than the next one.

The front lower molar is the longest of all the teeth; its crown is exactly that of the middle lower molar *plus* one more internal lateral triangle and the large anterior trefoil. Thus there are in all three external saliencies (two of them being closed lateral triangles) and four internal saliencies (three of them being closed triangles), without counting the lobes of the anterior trefoil, which give another saliency on each side; and likewise there are three external reëntrances and four internal reëntrances, without counting the nicks of the anterior trefoil, which give another reëntrance on each side. The posterior loop and the several lateral triangles of this tooth are pretty constant, but the anterior trefoil varies interminably in precise size and shape. It would be useless to attempt to give its endless minor modifications. But we should note that either lobe of this trefoil may closely simulate an additional lateral triangle; that this is particularly the case with the outer lobes, and, when it is accompanied by a forward extension of the median line of

enamel, the lobe is cut off from the rest of the trefoil, and transformed into an actual closed external triangle, of which, therefore, the tooth may show indifferently two or three. A step further in modification is this:—the trefoil, after being partitioned off as just explained, may develop an external lobe on its midleaf, and so remain in effect a trefoil, giving in all *five* external salencies, viz: one from the posterior loop of the tooth; two from the two closed triangles proper; one from the additional closed triangle; and one from the supplementary lobe of the trefoil.\* We have not noticed the same thing with the *inner* leaflet of the trefoil, but presume it may occur.

The upper molars reverse the pattern of the lower; their transverse loop is in front instead of behind, and the lateral triangles alternate from before backward instead of from behind forward; and the last upper molar ends behind, just as the first lower molar begins in front, with a formation not seen on any other teeth. The first upper molar, like the last under molar, is very constant throughout the whole genus; the last upper and first under are our diagnostic teeth for the several subgenera, though the middle ones, both upper and under, furnish collateral characters.

The front upper molar has in front a transverse loop, succeeded by two internal and two external alternating lateral closed triangles; the first of these being internal, the last postero-external. The salencies and reëntrances on both sides are sharp; the salencies, both external and internal, are three in number, counting a corner of the anterior loop in each enumeration.

The middle upper molar likewise consists of an anterior loop succeeded by alternating lateral closed triangles, but here the first is an exterior instead of an interior one. The anterior ellipse usually sits a little oblique, its convexity looking inward as well as forward. Regularly there are only two perfectly-closed lateral triangles on this tooth; first an exterior, then an interior, for the last one is as much posterior as interior, and not often regularly triangular. It may be called an exterior triangle, appendaged with a posterior lobe or spur representing an imperfect additional internal triangle.

\* This is our view of the formation of a variable number of lateral closed triangles in this tooth; it is simply a higher degree of complexity in the folds of the anterior trefoil. In *Pedomys* and *Pitymys*, the reverse, of *less* complexity, is seen. Here the median zigzag of enamel does not run so far forward; the anterior triangles are not fairly closed up, and their openness throws their dentine islets into one diamond-shaped area that is usually also continuous with the interior of the trefoil itself. This is nearly as good a character for distinguishing *Pedomys* or *Pitymys* from any style of *A. riparius* as that afforded by the back upper molar itself; though it is sometimes obscure, we have never seen the anterior lateral triangles fairly open in *riparius*, nor completely closed in the other two subgenera. *Chilotus*, however, is like *riparius* in this respect.

When this exterior triangle is most perfect—most like the antecedent one—then also it bears the most perfect supplementary internal spur; but oftener the two together have an indeterminate contour and a common dentine islet.\*

The last upper molar is the diagnostic tooth of this section of the genus. Certain European species show it exactly as in our forms; but in North America, as far as is known, no *Arvicola* but *xanthognathus* and the varieties of *riparius* show the peculiarity. This tooth consists essentially of an anterior transverse elliptical loop, one interior lateral closed triangle, two exterior lateral closed triangles, and a long oblique posterior crescent. The ellipse is succeeded first by the first exterior triangle, then by the single interior triangle, then by the other exterior triangle; the long anterior horn of the crescent bends inward to form a second interior saliency; the long outward convexity of the crescent bears the second exterior triangle upon its back, as it were; the posterior horn of the crescent curls inwardly to form a loop that finishes the tooth behind. With endless minor modifications, as matters of individual variability, this crescent is *always* recognizable and rarely obscure. Generally, it is seen at first glance, as something different from the U-, V-, or Y-shaped trefoils that end this tooth in our other subgenera. Really, of course, it is not a continuous enamel-wall thus stretching crescentic across the tooth; simply, the second (counting from backward) internal reëtrance is so deep that it pushes before it a fold of enamel till this touches and generally fuses with the external wall of enamel just behind the second external triangle. It is, in fact, this fusion that produces the last-named triangle itself. (In the other subgenera, the corresponding prism of the tooth is simply the exterior leaflet of the posterior trefoil, opening directly into the midleaf, through lack of the fusion that takes place in *riparius*.) Now let this second internal reëtrance be not quite deep enough to effect this closure, and we have the first modification of the crescent to be remembered, a slight break in its convexity, just at the posterior angle of the second external triangle. When, as occasionally happens, this break is considerable, the integrity of the crescent is destroyed, and we have a trefoil-like loop simulating that of the other subgenera. But, even in these most obscure cases, we have always found something in the configuration, perhaps not susceptible of definition,

\* This little subsidiary triangle is never, to our knowledge, developed at all in our other sections of the genus, and therefore, when evident, is a good character; but it is very liable to be overlooked—in fact, it was only after repeated examinations that we verified the nice distinction Baird drew (p. 514) in the matter of this tooth.

but which, especially in connection with the characters of the other teeth, proved decisive. The second noticeable modification of the crescent affects the posterior part of its convexity, which may develop a little lobe or spur simulating a third external triangle; then, as a necessary result, the curve is sinuate instead of regularly convex, having a little concavity in one part. The third principal modification is in respect of the posterior horn of the crescent. This is generally a simple lobe finishing the tooth behind; but it may, as one of endless slight changes, produce a sort of curved spur or hook. When this fold is pretty long, narrow, and curved, it looks like a little additional crescent lying in the belly of the main one. It is hardly necessary to add that none of these modifications have the slightest significance beyond indices of individual variability; and we should not have entered into the tedious minutiae except to bring this fact prominently forward, and to characterize the pattern of this important tooth in all its phases.

We shall open the discussion of *A. riparius* with the examination of nineteen typical specimens from the locality of the original *riparius* Ord. These were all collected at the same time and place, at a season of the year when they are necessarily full-grown, and were all prepared by the same person, in the same style of skin. Whatever differences, therefore, may be found are to be attributed to purely individual variation, of which we thus obtain a perfectly reliable equation, free from any disturbing functions, such as age, season, climate, locality, &c. Whatever variation in size and proportion may be found becomes a still purer index, if possible, from the fact that not one of these specimens is distinguishable from any one of the other eighteen in color; for, as far as color is concerned, they all might have belonged to the same litter. In respect of the measurements, we should premise that, as great care was taken in preparing the skins, probably no one of them differs in total length 0.25 from the original dimension in life, and that, if anything, the lengths as given are a trifle under life-size, from shrinkage in drying; and, secondly, that the loss in drying of the feet and tail may be estimated at about 5 per cent.

TABLE XXXIX.—Measurements of nineteen specimens of *A. RIPARIUS* from *Philadelphia*.

Number.	Locality.	Date.	Collected by—	Prepared by—	Head and body.	Tail vertebrae.	Palm of hand.	Sole of foot.
Final 13 specimens, unregistered—do. posted by author.	Philadelphia, Pa.	Nov. —, 1880	J. Krider	E. Cones	4.75	1.50	0.36	0.76
	do.	do.	do.	do.	4.60	1.55	0.37	0.79
	do.	do.	do.	do.	4.30	1.45	0.35	0.80
	do.	do.	do.	do.	4.25	1.40	0.36	0.70
	do.	do.	do.	do.	4.40	1.55	0.38	0.60
	do.	do.	do.	do.	4.50	1.60	0.35	0.75
	do.	do.	do.	do.	4.00	1.30	0.30	0.60
	do.	do.	do.	do.	4.00	1.45	0.34	0.60
	do.	do.	do.	do.	4.50	1.30	0.35	0.60
	do.	do.	do.	do.	4.30	1.55	0.34	0.60
	do.	do.	do.	do.	4.40	1.60	0.35	0.75
	do.	do.	do.	do.	4.25	1.45	0.36	0.78
	do.	do.	do.	do.	4.30	1.35	0.50	0.77
4342	do.	do.	do.	do.	4.00	1.25	0.30	0.70
4343	do.	do.	do.	do.	4.40	1.50	0.35	0.60
4344	do.	do.	do.	do.	4.25	1.25	0.31	0.70
4345	do.	do.	do.	do.	4.12	1.30	0.36	0.78
4346	do.	do.	do.	do.	4.40	1.30	0.34	0.75
4347	do.	do.	do.	do.	4.30	1.25	0.37	0.80
Average.....					4.35	1.42	0.35	0.77

It appears from this table that the average length is 4.35, and, in the best of our judgment, no allowance for shrinkage in the dimension is to be made. The extremes are from 4.00 to 4.75, a variation of three-fourths of an inch, or about 17 per cent. of the mean. The average of the tail, without its hairs, being 1.42, we may similarly set its true average length at an inch and a half; its variation amounts to 0.37, about the same percentage. The fore foot, averaging 0.35 in its present state, ranges from 0.30 to 0.38, that is, a variation of over 20 per cent.; but from the smallness of the measurement, the difficulty of placing the calipers upon exactly the same spot in the several specimens, and an actual difference in the position of the ball of the thumb when this is dried, the true percentage of variation would probably fall below 0.20, and thus be nearly the same as in the cases of the head and body and tail. The average dimension of the fore foot in life may be set at three-twelfths of an inch, or three lines. The hind foot, from the tuberosity of the heel to the end of the longest claw, can be measured with great exactness; it averages 0.77, and so may be fixed at 0.80, or four-fifths of an inch, in life; it varies 0.12, or very nearly 17 per cent., as before. With these calculations for absolute dimensions and variation, we may further consider

the same relatively:—The average head and body is to the average tail :: 4.35 : 1.50 :: 1 : 0.34; that is, the tail is almost exactly one-third as long as the head and body. The average fore foot is to the average hind foot :: 37 : 80; that is, it is a little less than one-half as long. It should be observed, likewise, that the variation in the proportional lengths of parts is considerable, *i. e.*, the longest trunk has not always the longest tail and feet, nor is a long hind foot always accompanied by an equally lengthened fore foot. These calculations, moreover, it should be remembered, really exhibit a *minimum* of purely individual variation; for the nineteen specimens occurred under the most similar conditions possible.

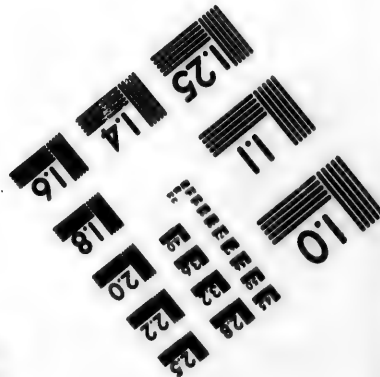
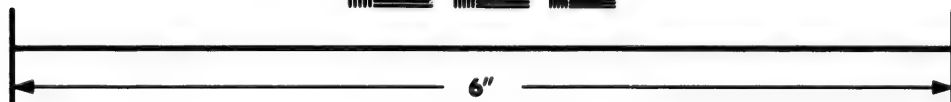
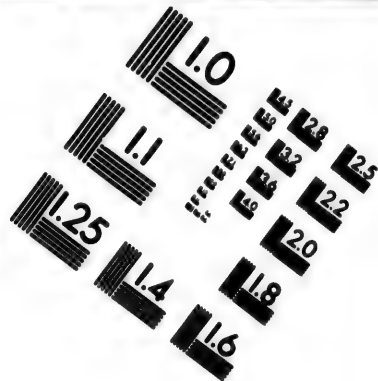
We shall next introduce a table of sixteen specimens, all from the same locality, but taken at different seasons, in different stages of growth, and prepared by different persons, for which reasons the series may be held to fairly express an *average of purely individual variability*. In color, they are all so much alike, that no tangible difference can be noted, some being merely a shade browner or grayer than others. On an average, they are a trifle browner or brighter than the Philadelphia series.

TABLE XL.—Measurements of sixteen specimens of *A. RIPARIUS* collected by J. W. P. Jenks, at Middleboro', Mass.

Number.	Sex.	Date.	Prepared by—	Head.	Head and body.		Tail to—		Palm of hand.	Sole of foot.	Remarks.
					Vert.	Hairs.	Vert.	Hairs.			
1433	♂	Mar. 11, 1856	S. G. Brown ...	1.43	4.85	1.80	1.98	0.37	0.75		The first nine specimens enumerated were skinned from alcohol by Mr. Brown, and the first four columns of measurements of these nine are his, as taken from the flesh. Some of his figures for the tails as given on the labels are obviously incorrect, and probably all are in excess, his point being taken too far inside the skin. All the other measurements are from the dried skins.
1434	♂	Sept. —, 1855	do .....	1.13	4.43	1.83	2.00	0.36	0.76		
1435	♀	Sept. —, 1855	do .....	1.70	4.27	1.56	1.75	0.38	0.80		
1436	♀	Sept. —, 1855	do .....	1.34	4.43	1.83	2.00	0.37	0.76		
1437	♂	Sept. —, 1855	do .....	1.33	4.40	1.83	2.00	0.36	0.75		
1438	♂	Sept. —, 1855	do .....	1.35	4.44	1.43	1.56	0.33	0.74		
1439	♂	Sept. —, 1855	do .....	1.25	4.13	1.50	2.03	0.38	0.77		
1440	♂	Sept. —, 1855	do .....	1.34	4.42	1.83	2.00	0.38	0.75		
1441	♂	Spring, 1856	do .....	1.35	4.10	1.56	1.83	0.39	0.80		
751	♂	June 8, 1855	J. W. P. Jenks. ....	4.33	1.40	1.50	0.33	0.70			
1101	...	Dec. 90, 1855	do .....	4.00	1.37	1.50	0.36	0.74			
948	...	Oct. 23, 1855	do .....	4.50	...	...	0.37	0.75			
709	...	July 9, 1855	do .....	4.25	1.55	1.70	0.36	0.75			
1432	...	Apr. 17, 1856	do .....	5.25	1.83	2.15	0.38	0.80			
1098	...	Nov. 5, 1855	do .....	5.75	1.60	1.80	0.30	0.75			No. 1098 is overstuffed, and Nos. 1432 and 1099 seem to be somewhat so.
1099	...	Nov. 11, 1855	do .....	5.00	1.80	2.08	0.40	0.80			

From this table it appears that the head, from point of the nose to the occiput, averages just one and a third inches in length, which is slightly less than one-third of the head and body together, and a little less than the average length of tail; its variation is 0.15, or a little over ten per cent. of





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the mean. The average length of the nine specimens, as measured fresh, is 4.30, and of the seven dried ones is 4.75; the result 4.52, as the true length of the animal, is slightly in excess of that deduced from the Philadelphia series, and precisely what we should expect from the increase in latitude. But before considering the limits of variability in total length of this series, we must allow for the probable changes produced in stuffing. Thus No. 1578, which was 4.10 long when fresh, measures in its present state only 3.75, without obvious "bunching up" of the skin; while No. 1098, with apparently moderate overstuffing, reaches 5.75, and it doubtless was at least 5.00 in life. Making due allowance for these contingencies, it will be quite safe to assume *one inch* in length of head and body as the fair average variability of mature individuals living in the same locality. It is beyond doubt that this capacity for variation will be found exemplified in every considerable series of adult specimens from any locality.

The tails of the above series average 1.66 in length; but this dimension, as we have remarked, is certainly in appreciable excess. We should not place the true average above 1.60 at most, and this would correspond precisely with the slight increase in average size of the Massachusetts over the Philadelphia series; the tail being, as before, one-third as long as the head and body. We have, however, a higher rate of variation in the length of the tail, viz, from 1.37 to 1.80 at least, which is almost half an inch. Although this may seem excessive, and be thought not quite reliable, owing to what we said of the measurements as taken, yet we are sure it is nothing unusual, and, in fact, we demonstrate further on, from consideration of more material, a greater variability of the tail than this. The pencil of hairs at the tip is a very inconstant feature, depending upon the general condition of the animal as to pelage, and perhaps upon season. It averages about a fourth of an inch, and ordinarily ranges between 0.10 and 0.30. The measurements of the feet, in the above table, are essentially the same as those of the Philadelphia series, and need not detain us, though we may gather the fact that increase in total stature is not always accompanied by corresponding increase in these members, since No. 1098, the largest of the specimens, has feet of only average dimensions.

As corroborative of the two foregoing tables, and as introducing new data in dimensions, we shall next present a table of sixteen specimens from slightly-separated localities (but of strictly the same geographical range), and separated from the localities already noticed by a considerable interval.

TABLE XL.—Measurements of sixteen specimens of *A. RIPARIUS* from Northwestern States.

Number.	Sex.	Date.	Locality.	Collected by—	Head and body.		Tail to end of—		Palm of hand.	Sole of foot.
					Vert.	Hairs.	Vert.	Hairs.		
744			West Northfield, Ill.	R. Kennicott	1.80	3.50	1.60	0.36	0.75	
745			do	do	1.60	3.97	1.40	0.27	0.82	
746			do	do	1.90	4.00	1.70	0.35	0.73	
741		Spring, 1853	do	do	1.40	3.75	1.30	0.30	0.78	
742		Jan. —, 1855	do	do	1.60	4.25	1.45	0.38	0.81	
743		Spring, 1855	do	do	4.35			0.40	0.85	
1604			do	do	3.65			0.38	0.84	
747	♀		Saint Louis, Mo.	Dr. G. Engelmann	1.70	4.50	1.57	0.37	0.80	
748	♀		do	do	1.55	4.90	1.45	0.36	0.75	
749	♂		do	do	1.85	4.40	1.70	0.39	0.80	
750	♂		do	do	1.70	3.75	1.50	0.33	0.85	
986			Racine, Wis.	Dr. P. H. Hoyer	1.45	4.25	1.25	0.34	0.76	
985		July 16, 1853	do	do	1.60	4.45	1.55	0.38	0.80	
987			do	do	1.40	4.00	1.35	0.35	0.78	
749	♂		Detroit, Mich.	C. Fox	1.85	4.50	1.60	0.38	0.80	
749	♀	Aug. —, 1853	Detroit River, Mich.	Prof. S. F. Baird	1.75	3.50	1.50	0.37	0.80	
Average						4.04	1.49		0.79	

These measurements are nearly all from dried skins, which nevertheless are so well prepared that there is no appreciable source of error. The average—barely over 4.00—is less than that of the Philadelphia series by about three-tenths of an inch, while the tails average rather more. While the proportion in the eastern series is as 1.00 to 0.34, here it is as 1.00 to 0.37. We also learn from this table of an interesting variability of proportionate length of tail to body. Thus No. 744, which is 3.50 long, and No. 745, 4.50 long, both have the same length of tail, 1.60; in the former the proportion is 1.00 to 0.46, and in the latter 1.00 to 0.36; that is to say, the tail may vary in specimens from substantially the same locality, from but little over one-third to nearly one-half the length of the trunk. The hind feet remain substantially the same as in the two preceding series (being slightly larger than the Philadelphia one and slightly smaller than the Massachusetts one), which, with the decrease in total stature, gives relatively a little larger foot of these specimens. In animals, then, from the Upper Mississippi Valley, we see a slight decrease in average stature, associated with a little longer (relatively) tail and hind feet. We desire it to be observed, for purposes of certain comparisons instituted beyond, that we have not yet seen any hind foot touch 0.90 in length, none exceeding, and but few reaching, 0.85.

[The peculiarities of pelage of a part of these Illinois and Wisconsin specimens, constituting the variety *longipilis*, are discussed elsewhere.]

Before taking up the intricate questions that western specimens present, and to complete our review of eastern examples, we continue with a *fourth* table, comprising all the rest of the dry specimens that have fallen under our observation from the United States east of the Mississippi.

TABLE XLII.—List of specimens (additional to those of Tables XXXIX, XL, and XLI) of *ARVICOLA RIPARIUS* examined dry from the United States east of the Mississippi, with measurements of many.

Number.	Sex.	Date.	Locality.	Collected by—	Tail to end of—				Sole of foot.	Remarks.
					Head and body.	Vert.	Hairs.	Paleofur.		
6036			Halifax, N. S.	Dr. J. B. Gilpin.	4.00	1.30	1.50	0.30	0.73	
6444			do	do	3.75	1.30	1.43	0.32	0.76	
10283			Labrador	Dr. J. Wyman.	3.75	1.50	1.70	0.36	0.73	Head 1.03.
10285		—, 1836	White Mountains, N. H.	do	1.00	2.00	0.33	0.73		
7780		—, 1864	E. Bethel, Vt.	C. S. Pease						Albino (= "albo rufescens").
1111	♀		Burlington, Vt.	Z. Thompson	4.50	1.75	1.90		0.80	
1112	♂		do	do	4.08	1.70	1.90	0.36	0.77	Head 1.53.
1113	♂		do	do	4.00	1.10	1.90	0.37	0.80	Head 1.33.
1114	♂		do	do	4.67	1.00	1.90	0.35	0.73	do.
1115	♀	Aug. 21, 1863	Wood's Hole, Mass.	S. F. Baird	4.90	1.70	2.10	0.43	0.86	
1116	♂	Aug. 21, 1863	do	do	4.50	1.60	1.80		0.79	
1117	♂	Sept. 2, 1863	do	do	4.25	1.50	1.70	0.39	0.83	
1118	♂	July 18, 1863	do	do	3.50	1.40	1.60		0.79	
1119	♀	July 23, 1863	do	do	3.50	1.25	1.35		0.79	
1120	♂	Sept. 12, 1863	Nantucket, Mass.	do	1.00	1.90	0.40	0.82		
1121	♂	Sept. 12, 1863	do	do	4.80	1.60	2.10	0.41	0.83	
1122	♂	Sept. 2, 1863	do	do	4.55	1.55	1.85	0.40	0.80	
1123	♀	July —, 1856	Muskeget I., Mass.	Dr. T. M. Brewer	4.30	1.65	1.94		0.85	Nose to eye 0.56, to ear 1.06; head 1.35.
1124	♂	July —, 1856	do	do	4.67	1.84	2.24	0.45	0.90	Nose to eye 0.59, to ear 1.18; head 1.40.
1125	♂	July —, 1856	do	do						Very young; this and Nos. 2530-1 types of "breueri".
1126	♂		Hingham, Mass.	do	4.50	1.03	1.83	0.33	0.83	Head 1.60 (f).
1127	♂		do	do	4.64	1.70	1.90	0.35	0.75	Head 1.21.
1128	♂		Holmes' Hole, Mass.	Dr. J. Wyman.	4.80	1.55	1.85		0.80	Type of "rufidorsum".
1129	♀	Sept. 13, 1863	do	S. F. Baird	4.75	1.60	1.80	0.40	0.80	Like "rufidorsum".
1130	♂	Oct. 24, 1855	Middleborough, Mass.	J. W. P. Jenks						Young.
1131	♂		Nantucket	Prof. L. Agassiz	4.90	1.40	1.55	0.34	0.85	Head 1.22.
4716		Nov. —, 1855	Newport, R. I.	S. Powell	3.00	1.35	1.50	0.31	0.75	Type of "boraealis".
4719		Nov. —, 1855	do	do	4.25	1.60		0.40	0.81	LeComte, 1863; not Richardson.
4720		Nov. —, 1855	do	do	1.40	1.00	0.35	0.85		Type of "maius".
4721			New York City	G. N. Lawrence						Very young.
4722			do	do	4.75	2.00	2.10		0.80	
4723			do	do	6.00	1.90	2.10		0.75	
4724			Essex County, N. Y.	S. E. Hale						
4725	♂	Sept. —, 1855	do	do	4.00	1.60	1.85		0.78	Head 1.33.
4726	♂		Nichols, N. Y.	R. Howe						Young.
4727	♀		do	do	4.10	1.00	1.90		0.78	Head 1.40.

TABLE XLII.—List of specimens (additional to those of Tables XXXIX, XL, and XLI) of *ARVICOLA RIPARIUS* examined from the United States east of the Mississippi, with measurements of many—Continued.

Number.	Sex.	Date.	Locality.	Collected by—	Head and body.	Tail to end of—		Palms of hind feet.	Sole of foot.	Remarks.
						Vert.	Hint.			
1315			Nichols, N. Y.	R. Howell	4.35	1.80	2.50	0.33	0.80	
1366	♂	Aug., 1896	Bosley's Point, N. J.	S. F. Baird	5.00	1.70	2.00	0.42	0.90	
1313		Sept., 1896	Carlisle, Pa.	do	4.50	1.45	1.60		0.75	
1314			do	do					0.79	
1315	♂		do	do	3.40					Head 1.30; young.
1316		Feb. 26, 1898	do	do	4.50	1.70	1.60		0.80	
1317		Feb. 26, 1898	do	do	3.25	1.75				
1318			do	do						Suckling.
9257	♂	Sept. 11, 1896	do	do	3.00	1.40	1.60		0.78	
9258			do	do	3.75	1.40	1.55	0.33	0.78	
9259	♂	Nov., 1896	do	do	3.40					Young.
9167			Williamsport, Pa.	L. McMillan	5.50	1.60	1.80	0.40	0.91	
9168			do	do	5.50	1.60	1.90	0.40	0.82	Very large and grisly specimens.
9169			do	do	5.75	1.85	2.00	0.37	0.90	
9170			Foxburgh, Pa.	Unknown	4.75	1.65	1.90		0.74	
9171			do	do	3.75	1.50		0.34	0.73	
4743		Nov., 1893	Columbia, Pa.	Major LeConte	4.25			0.30	0.72	Labeled "nasutus".
4744			do	do	5.00	1.60	2.05	0.40	0.85	do
4745			Philadelphia, Pa.	do				0.37	0.80	Type of riparius.
4746			Pennsylvania	do	4.00	1.40	1.60	0.36	0.83	
4747			do	do	5.10	1.50	1.70	0.45	0.93	
5128			do	J. K. Townsend	4.25	1.30	1.50		0.88	Labeled "xanthognathus".
5154			do	do	4.00	1.30	1.35		0.70	do
4725			Michigan	J. LeConte	4.50			0.39	0.80	
4726			Cleveland, Ohio	Dr. J. P. Kirtland	5.00	1.85	1.90	0.33	0.73	Labeled "nasutus".
4727			Racine, Wis.	Dr. F. R. Hoy						Suckling.
4728			Livingston Co., Mo.	do						do
4729			Saint Louis, Mo.	Dr. G. Engelmann						do
4730		Nov., 1893	Clarke County, Va.	W. H. Hensley	4.90	1.20	1.45	0.33	0.80	Head 1.25.
4731			Hillsborough, N. C.	M. A. Curtis	4.10	1.50	1.70	0.35	0.78	
4732			do	do	4.75	1.60	1.80	0.39	0.78	
4733			Prairie Mor House, La.	J. Faivre	3.50	1.30	1.40	0.33	0.77	
4734			do	do	4.00	1.10	1.10	0.37	0.82	
4735			Eastern United States	W. Cooper	5.25	1.55	1.75	0.40	0.90	Labeled "rufescens".
4736		—, 1896	do	Dr. T. M. Brewer	5.00					Very gray, like "breweri"; labeled "nasutus".
4737			do	Major LeConte						Young; labeled "nasutus".
1200			do	do	3.20	1.10	1.25	0.35	0.75	
			do	do	4.50	1.50	1.70	0.36	0.76	
			do	do	4.25	1.75	1.90	0.36	0.82	
			do	do	5.00	1.60	1.80	0.35	0.78	
			do	do		1.55	1.70	0.36	0.85	
			do	do	4.25	1.60	1.65	0.33	0.84	
Average					4.43	1.39			0.86	Green.
Minimum					3.19	1.10			0.75	
Maximum					5.75	2.00			0.93	

The large amount of material in this table gives the following results:—

The average length of the trunk (head and body) is 4.43, or slightly less than four and a half inches. The minimum, of apparently adult animals, is 3.50, the maximum is 5.75, and so two inches and a quarter is the gross amount of variation deduced from the figures as they stand. To make allowance, however, for probable error, both from inaccuracy of measurement and from imperfect preparation of the dried skins, from which most of the measurements are taken, and thus to keep largely within reasonable bounds, we will add 0.25 to the minimum and subtract 0.25 from the maximum. With this very liberal allowance, it will be seen that we have proven a net variation of *one and three-quarters inches* to occur in the sixty-three specimens measured.

The tail averages 1.59 in this series, with 1.10 and 2.00 as extremes. Making a fair allowance for error, as before, its true variation may safely be held at *three-quarters of an inch*. Its average length relative to the trunk is as 4.43 to 1.59 :: 1 : 0.36 nearly, or a little over one-third the length of the trunk.

The average hind foot is here 0.80, with 0.72 and 0.92 as extremes. Probably little or no allowance is here to be made for error, as the feet are never skinned, shrink but little in drying, and can be measured to a nicety. The hind foot, then, varies *two-tenths of an inch* in length.

We tabulate a *résumé* of the four preceding series, as far as the three principal measurements, of head and body, tail vertebrae, and hind foot, are concerned.

Series.	Number of specimens.	Length of head and body.			Tail (vertebrae).			Hind foot.		
		Average.	Maximum.	Minimum.	Average.	Maximum.	Minimum.	Average.	Maximum.	Minimum.
Philadelphia series.....	19	4.35	4.75	4.00	1.43	1.00	1.35	0.77	0.83	0.70
Massachusetts series.....	16	4.59	5.75	4.00	1.03	1.90	1.37	0.76	0.86	0.70
Illinois, &c., series.....	16	4.04	4.50	3.50	1.49	1.70	1.25	0.79	0.85	0.75
General series.....	63	4.43	5.75	3.50	1.59	2.00	1.10	0.80	0.92	0.72
	114	4.33	5.75	3.50	1.59	2.00	1.10	0.78	0.90	0.70

Combining the results of the 114 specimens, we have an average length of trunk of exactly *four and one-third inches*; a length of tail of 1.59, or almost

exactly *one and three-fifths inches*; and a foot of 0.78, or nearly *four-fifths of an inch*. The majority of the specimens run from 4.25 to 4.50 in length; a large proportion run between 4.00 and 5.00. Only eight specimens (about 7 per cent. of the whole) exceed 5.00, and only twelve (about 10 per cent.) of the adult ones fall below 4.00. The proportionally longest tail is as 0.41 to 1.00, or a trifle over two-fifths of the trunk; the shortest tail is as 0.27 to 1.00, or a little over one-fourth of the trunk; the average tail is to the average trunk as 0.37 to 1.00, or about three-eighths. Only a single foot of the 114 exceeds 0.90, and only three touch this figure; not one falls below 0.70.

The limits of what may be called *normal individual variability* are easily set from the foregoing figures, and the bounds of possible variation as readily perceived for both absolute size and relative proportion of parts. It must be observed that we have not yet presumed to inquire whether more than one species be represented in the series; but what we claim to have shown is that no more than one species can be predicated upon these specimens from *size and relative proportion of parts*, since the absolute dimensions grade imperceptibly between the extremes, and the relative measurements are inextricably interlaced.

As a supplement to the foregoing, we subjoin another table of more detailed measurements of numerous *alcoholic* specimens, all from the Eastern United States. This table extends and checks the above results to the last details of structure, and requires no further comment.

TABLE XLIII.—Measurements of forty-five (and list of many other) alcoholic specimens of *A. HIPARIUS* from the Eastern United States.

Carnoy number.	Sex.	Locality.	Collector.	From tip of nose to—				Tail to end of—	Length of—	Height of ear.	Nature of specimen	
				Eyes.	Ears.	Occiput.	Tail.					
7443	...	Halifax, Nova Scotia.	J. B. Gilpin.	3.45	1.10	1.95	4.20	1.00	2.40	3.04	2.20	Alcoholic.
9488	...	do	do	...	...	...	...	...	...	...	...	do.
9489	...	do	do	...	...	...	...	...	...	...	...	do.
9497	♂	Meadville, Pa.	J. F. Thickett.	3.71	1.09	1.36	4.20	1.00	2.00	3.44	3.04	do.
9531	...	Labrador	F. Wyman	...	...	...	...	...	...	...	...	Alcoholic; young.
9967	...	Lake Superior	George Baranov.	...	...	...	...	...	...	...	...	Alcoholic.
9470	...	do	do	...	...	...	...	...	...	...	...	do.
9883	...	do	do	...	...	...	...	...	...	...	...	do.
10573	...	do	do	...	...	...	...	...	...	...	...	do.
10574	...	do	do	...	...	...	...	...	...	...	...	do.
7381	...	Minnesota	R. F. Odell	...	...	...	...	...	...	...	...	do.
7397	...	do	R. Kennicott	...	...	...	...	...	...	...	...	do.
7590	...	do	do	...	...	...	...	...	3.25	3.75	...	do.



[illegible]

TABLE XLIII.—Measurements of forty-five (and list of many other) alcoholic specimens of *A. RIPARIUS* from the Eastern United States—Continued.

Current number.	Sex.	Locality.	Collector.	From tip of nose to—			Tail to end of—		Length of—		Height of ear.	Nature of specimen
				Eye.	Ear.	Occiput.	Tail.	Vert.	Fore foot.	Hind foot.		
7681	..	Germantown, Pa.....	M. Sergeant .....									Alcoholic.
10630		do .....	do .....									do.
10633		do .....	do .....									do.
7648	..	Beasley Point, N. J. ...	S. F. Baird .....	0.55	1.16	1.35	5.73	2.09	2.4	0.49	0.86	do.
10634	..	do .....	do .....	0.55	1.30	1.35	5.00	2.00	2.30	0.46	0.90	do.
7590	..	Burlington, Vt .....	Z. Thompson .....	0.58	1.15	1.30	4.6	2.10	2.35	0.45	0.88	do.
10636	..	do .....	do .....				4.30	1.40	1.55			do.
10637		do .....	do .....									do.
10643		do .....	do .....									do.
7680	..	Hingham, Mass .....	T. M. Brewer .....				5.73	1.60	1.68	0.43	0.88	do.
10646		do .....	do .....									do.
10650		do .....	do .....									do.
9088	♂	Muskeget Island .....	do .....	0.57	1.13	1.37	4.40	1.77	2.07	0.42	0.88	Types of "Breweri."
9089	♂	do .....	do .....	0.58	1.18	1.31	4.45	1.56	1.61	0.41	0.90	
9353	♂	do .....	do .....	0.40	0.98	1.08	3.10	1.31	1.34	0.40	0.81	
9063	♂	Carlisle, Pa. ....	S. F. Baird .....	0.45	0.98	1.25	3.50	1.35	1.55	0.36	0.90	Alcoholic.
9064	♂	do .....	do .....	0.50	1.00	1.30	4.40	1.60	1.65	0.44	0.83	do.
9065	♂	do .....	do .....	0.50	1.00	1.30	4.30	1.60	1.65	0.44	0.85	do.
9066	♂	do .....	do .....	0.45	0.95	1.16	3.7	1.49	1.6	0.40	0.80	do.
9067	♂	do .....	do .....	0.45	0.90	1.06	4.25	1.56	1.75	0.40	0.85	do.
9068	..	do .....	do .....	0.47	0.95	1.25	3.40	1.30	1.45	0.36	0.80	do.
9069	..	do .....	do .....	0.47	0.95	1.20	3.40	1.40	1.55	0.36	0.85	do.
9070	..	do .....	do .....	0.46	0.90	1.20	3.7	1.25	1.45	0.37	0.88	do.
10651		do .....	do .....									do.
10654		do .....	S. F. Baird .....									do.
9055	..	Mount Joy, Pa. ....	J. Snodder .....	0.40	0.96	1.30	3.75	1.25	1.40	0.40	0.84	Alcoholic.
9056	..	do .....	do .....	0.50	0.98	1.30	3.40	1.40	1.60	0.40	0.85	do.
9057	♂	do .....	do .....	0.50	1.00	1.30	4.15	1.65	1.65	0.41	0.85	do.
9058	♂	do .....	do .....	0.50	1.00	1.20	4.00	1.35	1.55	0.40	0.85	do.
9059	..	do .....	do .....	0.50	1.00	1.20	4.30	1.35	1.55	0.41	0.84	do.
9060	..	do .....	do .....	0.40	0.95	1.20	3.55	1.45		0.40	0.81	do.
9061	..	do .....	do .....	0.40	0.78	1.15	3.70	1.35	1.40	0.40	0.78	do.
9064	..	do .....	do .....	0.47	0.95	1.25	4.15	1.30	1.50	0.40	0.85	do.
9065	..	do .....	do .....	0.50	1.00	1.30	4.00	1.60	1.65	0.41	0.85	do.
9066	..	do .....	do .....	0.45	1.00	1.27	4.00	1.50	1.60	0.40	0.80	do.
9067	..	do .....	do .....	0.47	0.95	1.30	4.15	1.60	1.70	0.40	0.78	do.
9068	..	do .....	do .....	0.40	0.90	1.30	4.00	1.35	1.57	0.40	0.78	do.
9069	..	do .....	do .....	0.40	0.85	1.15	4.00	1.40	1.60	0.40	0.80	do.
9070	..	do .....	do .....	0.45	0.90	1.25	3.40	1.30	1.50	0.40	0.78	do.
9080	♀	Philadelphia, Pa .....	do .....	0.40	0.90		3.80	1.60	1.60	0.41	0.84	do.
9083	♂	do .....	do .....	0.40	0.84		3.40	1.10		0.38	0.78	do.
9088	..	Bradford County, Pa. ...	—f .....	0.45	0.90	1.30	4.75	1.64	1.60	0.40	0.75	do.
7594	..	Alleghany County, Pa. ...	R. O. Walker .....									do.
10655		do .....	do .....									do.
10673		do .....	do .....									do.

\* 7590 and some others from Burlington have unusually long tail, as in the Reg. "hyodes" from that region. But this feature does not mark them all; they vary half an inch.

TABLE XLIII.—Measurements of forty-five (and list of many other) alcoholic specimens of *A. RIPARIUS* from the Eastern United States—Continued.

Current number.	Sex.	Locality.	Collector.	From tip of nose to—				Tail to end of—		Length of—		Nature of specimen.
				Eya.	Ear.	Occiput.	Tail.	Vert.	Hind.	Fore foot.	Hind foot.	
7591	...	Salem, Ohio .....	Judge Newton .....	...	...	...	...	...	...	...	...	Alcoholic; very young.
10074	to	do .....	do .....	...	...	...	...	...	...	...	...	Alcoholic.
10098	...	West Northfield, Ill. ....	R. Kennicott .....	...	...	...	...	...	...	...	...	do.
3263	...	do .....	do .....	...	...	...	...	...	...	...	...	do.
3266	...	do .....	do .....	...	...	...	...	...	...	...	...	do.
3267	...	do .....	do .....	...	...	...	...	...	...	...	...	do.
10770	...	do .....	do .....	...	...	...	...	...	...	...	...	Supposed 5 very young.
10770?	...	do .....	do .....	...	...	...	...	...	...	...	...	Supposed 6 very young.
10780	to	do .....	do .....	...	...	...	...	...	...	...	...	Alcoholic.
10006	...	do .....	do .....	...	...	...	...	...	...	...	...	do.
7013	...	Pembina, Minn. ....	do .....	...	...	...	...	...	...	...	...	do.
10007	...	do .....	do .....	...	...	...	...	...	...	...	...	do.
10008	...	do .....	do .....	...	...	...	...	...	...	...	...	do.
10009	...	do .....	do .....	...	...	...	...	...	...	...	...	do.
10010	...	do .....	do .....	...	...	...	...	...	...	...	...	do.
9089	...	Wood's Hole, Mass. ....	S. F. Baird .....	...	...	...	...	...	...	...	...	do.
10011	...	do .....	do .....	...	...	...	...	...	...	...	...	do.
10012	...	do .....	do .....	...	...	...	...	...	...	...	...	do.
10013	...	do .....	do .....	...	...	...	...	...	...	...	...	do.

\* These 47 specimens not identified by tooth, with few exceptions. It is necessary to make a note of these for fear there may be some *Pedopus eremicus* among them.

TABLE XLIV.—Measurements of thirty-nine dry specimens of the *RIPARIUS* type from various localities in the United States west of the Mississippi.

Number.	Sex.	Date.	Locality.	Collected by—	Length.	Tail vertebra.	Size of foot.	Remarks.
9335	...	Aug. —, 1871	Yellowstone Lake .....	F. V. Hayden .....	2.75	1.30	0.67	
9336	...	Aug. —, 1871	do .....	do .....	2.75	1.30	0.74	
9337	...	June 19, 1871	Fort Nouf .....	do .....	4.30	1.30	0.78	
4317	...	...	Nebraska .....	do .....	4.50	1.30	0.70	
4318	...	...	do .....	do .....	4.50	1.30	0.78	
3244	...	...	do .....	do .....	3.50	1.30	0.78	
4338	...	July 1, 1880	do .....	G. H. Trook .....	3.40	1.30	0.74	
4339	♂	Aug. 10, 1896	do .....	W. B. Wood .....	4.25	1.40	0.78	Fresh: "5.00 in long; head 1.85".
4340	...	Aug. 30, 1896	do .....	do .....	3.25	1.05	0.70	Young.
4341	...	...	do .....	do .....	3.00	1.00	0.65	do.
3006	♂	Aug. 11, 1907	Cheyenne Pass, E. Mts. ....	do .....	3.00	1.00	0.65	do.
8498	♂	July 28, 18—	Cheyenne River, Dak. ....	S. M. Rothhammer .....	3.50	1.30	0.77	Immature.
3067	...	July 24, 1897	Medicine Bow Mountains .....	W. A. Hammond .....	3.25	0.70	0.63	Young.
4342	...	...	East of Fort Union .....	G. Suckley .....	2.00	0.75	0.80	do.
4343	...	...	Sawatch Pass .....	Kreisfeldt .....	2.75	0.90	0.60	Young; type of "modestus".
4344	...	...	do .....	do .....	2.75	0.90	0.65	Young; "modestus" f.
10989	...	...	Denver, Colo. ....	E. Palmer .....	4.00	1.30	0.70	Like "edax" in color.
8499	...	...	Central Plains .....	U. Wernigk .....	3.75	1.55	0.74	do.
3351	♀	Apr. 17, 1898	Fort Bridger, Utah .....	C. Drexler .....	3.00	1.25	0.68	Young.

TABLE XLIV.—Measurements of thirty-nine dry specimens of the RIPARIUS type from various localities in the United States west of the Mississippi—Continued.

Number.	Sex.	Date.	Locality.	Collected by—	Length.	Tail with hair.	End of tail.	Remarks.
3330	♂	May 20, 1895	Fort Bridger, Utah.....	C. Drexler .....	4.75	2.10	0.70	
3340	♂	June 9, 1895	.....do.....	.....do.....	3.73	1.00	0.70	
3346	♂	June 4, 1895	.....do.....	.....do.....	4.25	.....	0.70	
9613			Fort Whipple, Ariz.....	E. Palmer .....	3.90	.....	0.74	
9614			.....do.....	.....do.....	3.73	.....	0.68	
4171	♀	Mar. 31, 1895	Fort Crook, Cal.....	J. Fullmer .....	4.50	1.30	0.70	Dark-colored.
3064			.....do.....	.....do.....	5.00	1.50	0.77	.....do.
3065			.....do.....	.....do.....	4.75	1.25	0.85	.....do.
3066			.....do.....	.....do.....	4.85	1.25	0.76	.....do.
3067			.....do.....	.....do.....	4.25	1.40	0.73	.....do.
3068			Fort Tejon, Cal.....	J. Kantas.....	4.60	1.65	0.80	
3128	♀		Upper Pitt River, Cal.....	J. S. Newberry.....	4.50	1.50	0.73	Type of "longirostris".
3129	♂		Lower River, Cal.....	.....do.....	4.80	1.55	0.81	Labeled "montanus".
4473			Petaluma, Cal.....	E. Mammola.....	.....	1.50	0.60	Labeled "montanus?".
3217			Monterey, Cal.....	A. S. Taylor.....	4.33	1.60	0.63	Labeled "edax?".
3217			San Diego, Cal.....	J. F. Hammond.....	3.40	1.40	0.60	Labeled "edax?".
3218			.....do.....	.....do.....	4.40	1.85	0.60	Labeled "edax?".
4761			California.....	J. LeConte.....	4.00	1.53	0.90	Type of "edax". ["edax".
3733			.....do.....	U. S. Ex. Exp.....	3.20	1.41	0.63	Labeled "californicus"; like
10088			.....do.....	.....do.....	4.00	1.75	0.80	Type of "californicus".
10093			Puget Sound.....	.....do.....	3.50	1.07	0.67	Type of "occidentalis".
Average.....					4.18	1.53	0.79	

As will be seen, this series embraces the type-specimens of all the nominal species we are to discuss except "montana", and of this there is a typical example. The series was made up without the slightest reference to any desired or expected result, and simply includes, in fact, *all* the dry specimens that have come under our observation. The seven specimens marked "young" are not grown enough to furnish available measurements; and as they would vitiate the result if included, they are omitted in computing the average.

It is hardly necessary to more than allude to the average of this series as compared with the eastern ones. The total length falls between that of the Philadelphia and the Illinois series, and is 0.15 below the general average. The length of tail is within a just appreciable fraction of the grand eastern average, taking place between that of the general series and the Illinois series. The average proportion of body and tail is (4.18 : 1.53) as 1.00 to 0.34, precisely as in the Philadelphia and Massachusetts series. The average foot is precisely as in the Illinois series, and within 0.01 of the grand eastern average; only two feet touch 0.90, and none (of the adults) fall below 0.70.

But since several nominal species are represented in the list, which might collectively strike a general average without being severally on an average, it becomes necessary to discuss the series in detail. On running the eye over the column of lengths of *trunk* of the adults, it will be seen that they are imperceptibly graduated from 3.50 to 4.75, and that this graduation is independent of geographical or other considerations. We have only, then, to discuss the relative length of tail and feet as compared with the body.

Now, the specimens from Nebraska, Utah, and the upper and mountainous parts of California do not differ in any way from the eastern in size or shape (as will be seen by making a calculation from the figures). Those from the lower parts of California and the Pacific Coast itself (representing "edax", "californicus", and "occidentalis") average a little less (3.92; that is, 0.16 less) than the average of the whole; while the tails average a little more (1.31; that is, 0.15 more), giving a relative length of body and tail as  $3.92 : 1.68 :: 1.00 : 0.43$ ; while that of the whole eastern series is only  $1.00 : 0.37$ . The feet are correspondingly enlarged, averaging 0.84 instead of 0.79. We may say, therefore, that these specimens are a little smaller than usual, with tail and feet both absolutely and relatively a little longer. But we must remember that this is only one end of a very long series of 145 specimens, a great many of which shade up to this extreme, and some of which overlap it, and that the utmost of variation in these 39 specimens is fairly within the normal limits of variability we demonstrated for the eastern series. We now propose to *match* several individual specimens out of this series, as nearly as may prove possible, with eastern ones.

No. 4318 (Nebraska) is  $4.50 \times 1.60 \times 0.78$ , and No. 3525 (North Carolina) is  $4.75 \times 1.60 \times 0.79$ ; differing less than two specimens from Nebraska. No. 3551, from Utah, is  $4.75 \times 2.10 \times 0.78$ , and No. 857, from New York City, is  $4.75 \times 2.00 \times 0.80$ ; difference much less than that between the several Utah specimens. No. 3867 (Fort Crook) is  $4.25 \times 1.40 \times 0.83$ ; No. 4723, from Pennsylvania, is  $4.00 \times 1.40 \times 0.82$ ; the type of "longirostris" (No. 1268) is  $4.50 \times 1.50 \times 0.78$ ; a Philadelphia skin is  $4.25 \times 1.40 \times 0.70$  (precisely the same proportions). A typical specimen of "montana" is  $4.50 \times 1.55 \times 0.81$ ; a Philadelphia skin is  $4.60 \times 1.55 \times 0.82$ . The type of "edax" is  $4.00 \times 1.55 \times 0.90$ ; No. 903, from Nantucket, is  $4.20 \times 1.40 \times 0.85$ ; and No. 901 (type of *rufidorsum*) is  $4.20 \times 1.55 \times 0.82$ . The type of "californicus" is  $4.00 \times 1.75 \times 0.80$ ; No. 1578,

from Massachusetts, is  $4.00 \times 1.56 \times 0.80$ . "Occidentalis" alone has proportionally longer tail and feet than any other of the whole series, but it grades through "californicus" to the rest. The difference in the length of the foot between "occidentalis" and "californicus" is only 0.07, which of course furnishes no character of the slightest import, as we have seen a variation of more than twice as much in eastern specimens—enough to more than counterbalance the greater relative discrepancy, which is owing to "occidentalis" being a smaller individual. According to Baird's measurements, the tail of "occidentalis" is 2.00, and of *californicus* 1.50; but there appears to be some mistake here, and at any rate the specimens now in our hands show no such discrepancy, one being about  $1\frac{3}{4}$ , the other  $1\frac{1}{2}$ . They are both prepared in the same style, and apparently by the same person.

The above will be sufficient, we presume, to establish what we claim: that in points of size and shape there is no difference whatever between the eastern series and nearly all the western series, and that there is no difference in these respects of specific import or even enough to constitute a geographical variety in any of the 145 specimens; and that, therefore, if more than one species is to be established, it must be upon something else than size or shape.

To this we should add a word concerning *Arvicola* "modesta". We regret that we cannot agree with the proposer of this species, that although it is "not quite grown, the skull shows that it would not attain to much greater size". To our view, this skull is that of a very young animal, as shown by its size, smoothness, fragility, absence of muscular impressions, loose sutures, &c. It corresponds in these and all other respects with several specimens of very young eastern and western *Arvicola* measuring two or three inches long; while the external dimensions are the same as those of the several young ones with which it is associated in the last series given.

We supplement the foregoing table with one of more detailed measurements from alcoholic specimens, dismissing it with the remark that it amply confirms what has been already deduced.

TABLE XLV.—Measurements of thirteen alcoholic specimens of *A. RIPARIUS* from the United States west of the Mississippi.

Number.	Locality.	Collector.	Nose to—				Tail to end of—		Fore foot.	Hind foot.	Ear.	Remarks.
			Eye.	Nar.	Occiput.	Tail.	Vert.	Hairs.				
7611	Fort Bridger, Utah*	C. Drexler .....	0.43	0.98	1.18	4.50	1.90	1.30	0.38	0.70	0.50	
10049 to 10067	do .....	do .....										
7737	do .....	C. S. McCarthy .....				3.25	1.90	1.35		0.74		
10066	do .....	do .....	0.43	0.95	1.17	3.75	1.85	1.45	0.33	0.73	0.42	
10069	do .....	do .....	0.45	0.96	1.90	3.90	1.30	1.45	0.40	0.83	0.45	
10070	do .....	do .....	0.50	1.00	1.30	4.10	1.65	1.90	0.38	0.77	0.53	
10071	do .....	do .....	0.47	1.00	1.90	4.00	2.00	2.15	0.40	0.86	0.58	
10072	Carson Valley .....	do .....										
7738	Fort Kearney .....	do .....	0.52	1.00	1.93	4.75	1.90		0.40	0.80	0.59	
1005	Medicine Bow Creek .....	W. S. Wood .....	0.40	0.80	1.10	3.90	1.19		0.17	0.70	0.43	
1260	Klamath Lake .....	J. S. Newberry .....										Young.
1270	Upper Des Chutes .....	do .....										do.
4535	Upper Platte River .....	C. Drexler .....	0.50	1.00	1.95	4.00	1.85	2.65	0.40	0.80	0.55	
7571	Black Hills, Dak .....	F. V. Hayden .....	0.45	0.98	1.15	4.00	1.30	1.50	0.38	0.80	0.45	
10073	Fort Shaw, Mont .....	R. B. Hils .....					1.30	1.50		0.70		
7681	Fort Crook, Cal .....	J. Fellner .....										Young.
7739	Fort Tejon, Cal .....	J. Xantus .....	0.55	1.05	1.40	4.50	2.00	2.10	0.40	0.90	0.57	
9536	San Diego, Cal .....	J. F. Hammond .....	0.59	1.10	1.30	4.30	1.80	1.90	0.45	0.81	0.55	
9893	Monterey, Cal .....	Dr. Caulfield .....										Young.
9898	do .....	do .....										do.
10074 to 10081	do .....	do .....										do.

\* Drexler's numerous Fort Bridger specimens we have not thought necessary to measure in detail, as they differ but little, and are precisely like the dry ones already presented. McCarthy's, from the same locality, show a good deal of difference in length and stoutness of tail. It will be observed that these specimens, which we cannot distinguish even as a local strain, from ordinary *riparius*, were collected in company with a lot of *A. sylvaticus* var. *decurtatus*, which seems common in that locality, and is distinguishable at a glance. Even the collectors appear to have separated the two species, to judge from the labels.

† By some misprint in Baird's work, Nos. 1900, 1970 are given as mounted, whereas they now lie before us in alcohol.

Having exhausted our data of size and external shape, we will next interrogate an extensive series of skulls of eastern and western *Arvicolas* of the *riparius* section, to see if there be any *cranial* characters upon which more than a single species may be predicable.

TABLE XLVI.—Measurements of sixty-eight skulls of eastern and western specimens of ARVICOLA RIPARIUS.

Number.	Locality.	Length.	Height.	Width at—		Length of upper molars.	Length of upper incisors.	Under jaw from tip of incisors to—			Length of under molars.	Length of under incisors.	Remarks.
				Zygoma.	Orbit.			Apex of coronoid.	Back of condyle.	Apex of descending process.			
9111	Burlington, Vt.	1.03	0.41	0.60	0.18	0.27	0.18	.....	0.73	0.76	0.97	0.30	
9112	do	1.08	0.42	.....	0.16	0.27	0.20	0.56	0.74	0.83	0.98	0.33	
9113	do	1.08	0.42	.....	0.16	0.27	0.20	0.56	0.74	0.83	0.98	0.33	
9114	do	1.06	0.40	0.50	0.17	0.25	0.17	0.58	0.77	0.80	0.97	0.30	
9115	Middleborough, Mass.	1.07	0.43	0.63	0.17	0.27	0.20	0.61	0.77	0.83	0.98	0.30	
9116	do	.....	.....	.....	0.15	0.27	.....	.....	0.79	0.85	0.90	0.30	
9117	do	1.05	0.40	0.62	0.16	0.28	0.20	0.62	0.78	0.80	0.98	0.30	
9118	do	.....	0.40	0.63	0.18	0.27	0.24	.....	0.80	.....	0.90	0.35	
9119	do	.....	.....	.....	.....	.....	0.24	0.55	0.70	.....	0.95	0.35	
9120	do	1.05	0.43	0.61	0.16	0.28	0.21	.....	0.80	.....	0.98	0.35	
9121	do	.....	0.44	0.63	0.18	0.28	0.20	0.62	0.80	.....	0.97	0.35	
9122	do	.....	0.43	0.60	0.17	0.28	0.20	0.60	0.78	0.82	0.98	0.30	
9123	do	.....	.....	.....	.....	.....	0.20	.....	.....	.....	0.96	0.37	
9124	do	1.01	0.39	0.55	0.15	0.24	0.22	.....	0.74	0.78	0.94	0.30	
9125	Muskeget, Mass.	.....	.....	.....	0.14	.....	0.17	0.66	0.67	.....	0.97	0.33	
9126	do	1.20	0.43	0.69	0.15	0.28	0.23	.....	0.87	0.90	0.99	0.36	
9127	do	1.09	0.40	0.65	0.16	0.27	0.19	0.60	0.77	0.70	0.98	0.35	
9128	Hingham, Mass.	1.06	0.40	0.61	0.17	0.26	0.20	0.63	0.87	0.81	0.97	0.35	
9129	Wood's Hole, Mass.	1.06	0.44	0.65	0.16	0.26	0.22	.....	0.83	0.84	.....	0.98	
9130	do	1.00	.....	0.58	0.15	.....	0.15	.....	.....	.....	.....	0.96	
9131	do	1.12	0.45	0.65	0.18	0.29	0.22	.....	0.81	0.89	0.99	0.34	
9132	do	1.09	0.41	0.58	0.14	0.27	0.20	.....	0.75	0.80	0.98	0.30	
9133	Holmes' Hole, Mass.	1.10	0.44	0.64	0.15	0.29	0.25	0.80	0.85	0.89	0.90	0.31	
9134	do	1.11	0.42	0.62	0.17	0.27	.....	0.73	0.81	0.86	0.97	0.37	
9135	Nichols, N. Y.	1.08	0.40	0.61	0.16	0.26	0.22	0.80	0.78	0.83	0.97	0.36	
9136	Essex County, N. Y.	.....	.....	.....	.....	.....	.....	.....	0.70	0.75	0.97	0.30	
9137	Philadelphia, Pa.	1.14	0.44	0.61	0.18	0.28	0.24	.....	0.80	0.84	0.99	0.34	
9138	Foxburgh, Pa.	1.12	0.45	0.70	0.17	0.26	0.20	.....	0.78	0.82	0.98	0.30	
9139	do	1.03	0.39	0.57	0.16	0.24	0.21	0.56	0.72	0.80	0.95	0.33	
9140	Carlisle, Pa.	.....	.....	.....	0.17	.....	0.20	.....	.....	.....	.....	.....	
9141	do	1.06	0.44	0.62	0.17	0.27	0.20	.....	0.82	0.86	0.90	0.36	
9142	do	1.05	0.43	0.63	0.16	0.25	0.24	0.61	0.79	0.83	0.98	0.34	
9143	do	1.08	0.40	.....	0.15	0.27	0.18	0.69	0.80	0.83	0.90	0.33	
9144	do	1.06	0.42	0.64	0.16	0.27	0.21	.....	0.80	0.83	0.95	0.32	
9145	do	1.07	.....	0.60	0.15	.....	0.18	0.60	0.75	0.80	0.95	0.30	
9146	do	1.08	0.40	0.60	0.14	0.25	0.21	0.56	0.76	0.81	0.98	0.32	
9147	do	.....	.....	.....	.....	.....	0.26	0.19	0.37	0.71	0.79	0.95	0.30
9148	Pennsylvania	1.00	0.40	0.53	0.17	0.24	0.20	0.54	0.70	0.71	0.95	0.36	
9149	do	1.07	0.40	0.60	0.15	0.27	0.22	0.83	0.79	0.89	0.95	0.31	
9150	Washington, D. C.	1.12	0.45	0.66	0.18	0.26	0.22	0.78	0.83	0.90	0.98	0.36	
9151	Clark County, Va.	1.00	0.39	0.56	0.16	0.27	0.21	0.43	0.78	0.82	0.97	0.31	
9152	West Northfield, Ill.	1.05	0.43	0.58	0.15	0.27	0.22	0.59	0.77	0.81	0.98	0.31	
9153	do	1.06	0.43	0.60	0.17	0.28	0.24	0.60	0.80	0.82	0.97	0.32	
9154	do	1.10	0.46	0.68	0.15	0.29	0.23	0.75	0.80	0.86	0.98	0.31	
9155	do	1.06	0.42	0.61	0.15	0.27	0.21	0.62	0.78	0.82	0.97	0.31	
9156	do	1.00	0.36	0.56	0.14	0.25	0.22	0.60	0.74	0.79	0.95	0.30	
9157	do	0.96	0.38	0.64	0.14	0.24	0.20	0.58	0.74	0.77	0.94	0.33	
9158	do	0.95	0.35	0.59	0.13	0.24	0.18	0.59	0.70	0.79	0.94	0.35	Not full grown.
9159	do	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
9160	Detroit, Mich.	.....	0.40	0.60	0.16	0.28	0.21	0.59	0.77	0.80	0.98	0.35	
9161	Detroit River, Mich.	1.00	0.38	.....	0.16	0.25	0.17	0.56	0.78	0.77	0.97	0.30	



TABLE XLVI.—Measurements of sixty-eight skulls of eastern and western specimens of *ARVICOLA RIPARIUS*—Continued.

Number.	Locality.	Length.	Height.	Width at—		Length of upper molar.	Length of upper incisors.	Under jaw from tip of incisors to—			Length of lower molar.	Length of lower incisors.	Remarks.
				Zygoma.	Orbit.			Apex of coronoid.	Back of condyle.	Apex of descending process.			
1111A	Racine, Wis .....	1.03	0.40	0.58	0.16	0.35	0.21	0.60	0.78	0.98	0.37	0.33	
1111B	Saint Louis, Mo .....	1.04	0.42	0.63	0.17	0.36	0.18	0.51	0.78	0.90	0.37	0.31	
1111C	.....do .....	1.04	0.39	0.60	0.18	0.37	0.24	0.60	0.90	0.83	0.37	0.38	
1111D	.....do .....	1.08	0.40	0.56	0.18	0.39	0.30	0.56	0.74	0.77	0.35	0.33	
1111E	.....do .....	1.10	0.43	0.67	0.18	0.37	0.33	0.64	0.90	0.93	0.37	0.34	
1111F	Prarie Mer Rouge, La. ....	.....	.....	0.60	0.16	0.35	0.30	.....	0.78	0.79	0.35	0.30	
1111G	.....do .....	.....	.....	0.63	0.15	0.37	0.32	.....	0.80	0.81	0.37	0.33	
1111H	Monterey, Cal .....	1.00	0.40	0.68	0.15	0.35	0.17	.....	.....	.....	.....	.....	menisane!
1111I	.....do .....	1.12	0.41	.....	0.16	0.36	0.18	0.62	0.69	0.84	0.39	0.33	edae.
1111J	Petaluma, Cal .....	1.13	0.44	0.69	0.14	0.30	0.33	0.86	0.81	0.85	0.39	0.33	menisane!
1111K	San Diego, Cal .....	1.16	0.49	0.64	0.17	0.30	0.39	0.77	0.90	0.85	0.39	0.30	edae.
1111L	Upper Pitt River, Cal .....	1.08	.....	0.61	0.15	0.37	0.32	0.64	0.62	0.84	0.39	0.32	long rostris.
1111M	Lost River, Cal .....	1.03	0.43	0.62	0.15	0.37	0.32	0.63	0.60	0.87	0.33	0.37	
1111N	Fort Tejon, Cal .....	1.05	0.42	0.63	0.14	0.33	0.32	0.61	0.79	0.80	0.31	0.36	
1111O	California .....	1.14	0.43	0.65	0.19	0.38	0.32	0.82	0.81	.....	0.37	0.32	colliformous.
1111P	Des Chutes, Oreg .....	1.07	0.40	0.63	0.15	0.35	0.30	0.60	0.80	0.84	0.35	0.33	
1111Q	Puget Sound, Oreg .....	1.13	0.43	0.68	0.18	0.37	0.31	.....	0.81	0.83	0.39	0.33	occidentalis.

The blanks in the foregoing table are owing to the defective condition of certain specimens. The measurement of the length is made from the tip of the nasal bones to the upper border of the foramen magnum. The height is the perpendicular from the posterior corner of the last upper molar. The orbital width is at the point of greatest constriction of the orbit. The zygomatic width is at the broadest point of the zygomatic arches. The molar series are measured from anterior corner of the first molar to posterior corner of the last one. The length of incisors is their protrusion from the alveoli. The condyloid dimension is measured to the back corner of the condyle.

The average length of the whole series is 1.08; the minimum\* is 1.00 and the maximum 1.20, the latter occurring in one of the "breweri" specimens. The variation is, therefore, 0.20, or about 20 per cent. of the mean. The average zygomatic width is 0.64; the maximum 0.69; the minimum 0.55. The proportion of length to width is, therefore, as 1.08 to 0.64, or as 1.00:0.59. The molar series in both jaws is about the same, and averages a little over 0.25 of an inch (from 0.24 to 0.30); the upper incisors protrude about 0.20 on an average (from 0.17 to 0.24); the under are rather

\* Of adult specimens: several young skulls, ranging from 0.80 to 1.00, are excluded from the table.

more than half as long again as the upper, averaging about 0.33 (from 0.27 to 0.38). An interesting point is seen in the eighth and ninth columns: the distance from the tip of the lower incisors to the apex of the descending process of the jaw is invariably a little greater than that from the same point to the back of the condyle. This probably characterizes this section of the genus; for in *Pitymys*, at least, and perhaps some other sections, these two measurements are equal. The number of western skulls (eight) is too few to institute any very critical comparison; they average  $1.10 \times 0.64$ , while the eastern ones are  $1.06 \times 0.65$ ; there is every probability that this disproportion would disappear with larger series. It is only to be noted further that No. 4156 *his* (type of *occidentalis*) is among the largest skulls of the series; tending to show that the present dimensions of the skin ( $3\frac{1}{2}$  inches) are below the truth, and, therefore, that the disproportion we found in the length of its tail and feet is really not so great as appears from the dried skin. Its dimensions are in no wise appreciably different from those of "californicus", No. 4156.

No. 4444 is the type of *A. "longirostris"*, and must be examined in this connection; for, as we have shown, there is nothing in the dimensions, nor, as we shall show beyond, is there anything in the coloration that cannot be exactly matched in almost any half-dozen samples of *riparius*. The diagnosis is:—"Skull  $1.08 \times 0.61$ , or as 1.00:55. Muzzle of skull very long. Distance between upper molars and incisors more than one-third the whole length of the skull." But this length, 1.08, is precisely what we found as the average of the whole series. The width, 0.61, is within 0.03 of the average. Skull No. 4444, from New York, gives precisely these dimensions,  $1.08 \times 0.61$ ; several others approach it within one or two hundredths. I can appreciate but one single discrepancy between this skull and an average one. The incisors are a little tilted forward, so that their tips fall in advance of a perpendicular from the tips of the nasals, instead of *about* under the ends of the nasals, as usual. This, with the corresponding change in the alveolus, makes the distance from the incisors to the molars just appreciably greater than usual; thus it is 0.37 in "longirostris", and only 0.34 in the New York skull just cited. But the molars are not "thrown further back than in other species"; for, on taking their bearings from any other points of the skull than the incisors, they will be found in the usual position. Examination of a number of skulls with reference to the "set" of the incisors shows that this is very variable; their tips may fall behind, below, or in advance of the nasals, and

"longirostris" is only a slight increase in the forward tilting they often show; in fact, several eastern skulls differ more among each other than one of them (No. 1177) does from *longirostris*. There is nothing peculiar in the dentition of the latter.

*A. breweri* is stated to be narrower behind the zygomatic arches, and to have the interparietal acute instead of subtruncate. At a particular point across the back of the skull, it measures 0.40; several other skulls measured at the same point give dimensions equal to, greater than, and less than this. No two specimens in the whole series of skulls are exactly alike as to the lateral corner of the interparietal; sometimes it is an edge instead of a corner, sometimes obtuse, sometimes acute; and when thus attenuated, as it frequently is, the sharp spur may be turned backward, forward, or neither way.

Our general description of the skull and dentition of *riparius* is made elsewhere; here we will merely inquire whether or not any of the dental peculiarities ascribed to the several nominal species will hold good.

A peculiarity of the last upper molar of *A. californicus* is stated to be a short lobe that the posterior crescent sends outward near its posterior portion; but we cannot agree with the author that this is a "character rarely observed among American *Arvicolæ*". It is, in fact, not an unusual condition of the several inextricably-graduated variations of this last upper molar; we have seen it frequently, and, in one specimen we have just picked up (No. 1177), the variation is carried to such extreme that the back part of what ought to have been the convexity of the crescent is made concave. The "supplementary internal lobe" of the same tooth of "*occidentalis*" is a very common feature in eastern and other skulls. Not to prolong this inquiry further, we may state that we have satisfied ourselves by personal examination that no one of the supposed western species possesses any dental features not matched by examples of eastern *riparius*.

We will next turn to the matter of color.

As already stated, there is no appreciable variation in color in the nineteen Philadelphia skins, unless it is that some of them have the tail a trifle more decidedly bicolor than others; but in none is the definition of the lighter and darker surfaces very distinct. They are gray-brown, darker along the middle of the back, especially toward the tail. A bay tinge or reddish-brown is scarcely appreciable; so that, without being at all "blackish" in general hue, the shade is darker than that of rufescent specimens.

The shade is slightly grizzled with dull yellowish-brown. Beneath, the plumbeous hairs are all tipped with white, resulting in a hoary-ash, which is clearest (whitest) on the breast and belly, darkest on the throat; there is no line of demarkation between upper and under parts. There is no cinnamon, tawny, nor muddy tinge underneath; but a faint brownish wash, like an extreme dilution of the color of the sides, is barely perceptible.

This typical coloration prevails in the majority of eastern specimens in the present collection. Nearly all those from the Middle States, others from Nova Scotia, Massachusetts, the Carolinas, Wisconsin, &c., are not appreciably different. Other specimens show a departure from this standard in three courses: toward "red", "black", and "gray". The extreme of the rufescent variation is reached in No. 111, type of "*rufidorsum*". In this, the color is an intense tawny above, a little darker on the rump, paler on the sides, and washing the under parts. The feet share the general tawny hue. This extreme case is not nearly matched by anything else in the collection, and raises a strong suspicion of an albinotic element. We know by the "*albo-rufescens*" of Dr. Emmons that such a state does occur; although there is really a gap in the eastern series between "*rufidorsum*" and the rest, yet many specimens grade *nearly* up to it. In the Massachusetts series, where some (particularly winter and early spring skins) are quite as dark as any Philadelphia ones, others are very much brighter. No. 111, for example, is very rufescent, from predominance of bay in the hairs. A Labrador specimen (111) is rather brighter still; No. 111, from Nichols, N. Y., and a Pennsylvania skin, No. 4724, labeled "*riparius*" by LeConte, are quite as bright; so are a few of the Illinois and Missouri ones, and one from Louisiana (111). But the link between the extreme of *rufidorsum* is afforded by No. 10083, the type of "*occidentalis*", which might be described in identical terms; and, although the tawny is not quite so vivid, it similarly tinges the feet.

The extreme of paleness or grayness is illustrated in what has been called "*breweri*". In this, the upper parts are of a light dull grizzly-gray, with a small proportion of yellowish-brown, and the under parts soiled white; the hairs being only plumbeous at the extreme base, and consequently scarcely shading the whitish. The cause and nature of this variation have been so perfectly explained by Mr. Allen\* that I shall quote his words:—"On Muskeget Island (a small, uninhabited, low sandy island between Nantucket and

\* Mammals of Massachusetts, in Bull. Mus. Comp. Zool. No. 8, p. 332.

Martha's Vineyard) I recently found the so-called *A. breweri* excessively abundant. This is the only locality from which this supposed species has been reported. They are generally much paler in color than the *riparius* of the interior, and though not differing from them appreciably in other respects, they form an interesting insular race. From the peculiar character of the locality, the scattered beach grass growing upon it affording but slight protection from the sunlight, the intensity of which is greatly heightened by the almost bare, light-colored sands, the generally bleached appearance of the Muskeget *Arvicola* might have been anticipated. Specimens occasionally occur of nearly the ordinary color, or which are undistinguishable from the lighter-colored specimens from the interior: but most of them seem to be quite like the ones described by Professor Baird. The mice living in the extensive sand dunes at Ipswich under circumstances similar to those of the Muskeget mice, often present the half white appearance of *A. 'breweri'*."

We were at first inclined to regard "breweri" as an isolated case of *riparius*; but the facts of the Ipswich mice, as given by Mr. Allen, and some intermediate specimens before us, show such a gradation that we cannot draw any line. Thus, No. 4713 (unlabeled as to locality) is much grayer than average *riparius*, but not quite up to "breweri". It likewise resembles "breweri" in the texture of the pelage, the fur having the same coarse, harsh, lustreless character. Now, this style of fur is enumerated among the features of *A. 'edax'*, and characterizes all the specimens from the southern and lower parts of California, where the infrequency of rain diminishes or altogether precludes forest-growth, and places the animals under conditions similar to those of Muskeget. An unregistered specimen\* of LeConte's from the Eastern United States, undistinguishable from No. 4713, is *absolutely identical*, in color and texture of fur, with several Californian skins (as Nos. 3669, 2525, 2524) marked "edax"; is not appreciably different from LeConte's type of "edax", nor from Nebraska (as No. 4318) and Utah (as No. 3350) specimens. The type of "californicus" combines the loose, coarse pelage of "edax", with a rufescent hue approaching "occidentalis". Specimens of supposed "montana" and the type of "longirostris" are precisely matched in the color and texture of the fur with any of the rather grayer examples from the east. Of the two specimens referred (one with a query) to "*A. modesta*", one, the type, No. 4747, is much

\* This specimen is labeled, in the handwriting of all of the lot received from Major LeConte, "*nasutus* Bach., *riparius* DeKay, *novboracensis* Rich., *palustris* Harlan".

darker than the other, ~~Wt~~; but either can be matched in color by both adult and young examples from other localities.

The third line of variation, into unusual darkness, is fully illustrated in the series. The darkest Atlantic example is a very large one from Beesley's Point, N. J. The muzzle, feet, and tail are almost black, and the latter is hardly appreciably paler underneath than on top, and has no line of demarkation whatever. The fur combines shortness, thickness, and great gloss with a coarse, bristly texture; the longer glossy hairs being so numerous as to recall the pelage of a muskrat. The other darkest specimens are the series from West Northfield, Ill., and Racine, Wis., and that from Fort Crook, Cal. In these, there is no, or no appreciable, rufescent shade, and the blackish-brown is considerably grizzled with gray. The West Northfield and Fort Crook examples are among the most closely matched of the whole series; absolutely no difference is to be observed. They present the very long, dense, and almost fluffy character of pelage upon which the variety "longipilis" was founded. The fur of *Arvicolas*, however, varies in these points so much, with age, health, season of the year, and climate, that "longipilis" cannot constitute even a permanent variety. Only a part of the Illinois series exhibits the feature, and it is represented solely by winter or early spring skins. The Fort Crook specimens, as just stated, are identical, and others on the Atlantic side approach to or recede from the character in indefinite and endless degree.

The coloration of the tail, whether bicolor or not, is often introduced into specific diagnoses. In general, the tail above corresponds with the color of the back, whatever that may be, and below with that of the belly; and usually there is an obvious dividing line between the two colors. This line may be sharp, straight, and conspicuous, or completely wanting, when the color above shades insensibly into that below; and in either case the difference between the two colors may be conspicuous or barely or not perceptible. In one specimen (No. 988, Racine, Wis.), the tail is of almost precisely the same dark-brown tint above and below, but has a large pencil of snow-white hairs at the tip. The condition of this pencil of hairs is extremely variable, as shown in the table of measurements; it varies from almost nothing to three or four lines in length.

Although it is hardly necessary to discuss any of the names that have not been admitted since 1857, yet the *Arvicola* "nasuta" of Audubon and

Bachman claims some attention on account of the very singular characters upon which it rested. It is stated to be "larger than *Arvicola pennsylvanica*; tail shorter than the head; legs small and slender; nose sharper than in *Arvicola* generally; length 5½; head 1½; tail 1½; heel to point of nail ½". It is based upon a specimen from Boston, Mass., and others are cited from New York and Michigan. As will be seen from the foregoing tables, we have several specimens ranging from five to nearly six inches—three from Massachusetts, six from Pennsylvania, and five others, and their tails range from 1.50 to 1.80. But there is nothing like the shortness of the feet, as stated. This is certainly an error. Even the diminutive *A. oregonus* has the feet considerably over half an inch; and this length, for an animal nearly six inches long, does not, we are confident, obtain in this genus. There are other indications of error in the account, and we are satisfied that no such character as unusual sharpness of the nose occurs in any of the many specimens we have examined, although several of them are labeled "*nasutus*". The authors evidently had before them some very large, overgrown specimen of *riparius*, like those old individuals above enumerated from Williamsport, Pa., and committed some error, typographical or otherwise, in their measurements.

The *Arvicola* "oneida" of DeKay is certainly based upon a young example of *riparius*. The only other animal it could possibly be is the *A. pinetorum*; but the measurements given preclude this reference. Audubon and Bachman refer "oneida" in one place (ii, 219) to *pinetorum*, and in another (iii, 287) to their own *fulvus* or *dekayi*, which latter, however, is *Evotomys gapperi*. The *Arvicola rufescens* of DeKay is certainly *riparius* also. Some of the expressions point toward *Evotomys gapperi*; but the statement "upper molars with nine external angles" is only applicable to the section of the genus to which *riparius* belongs, while the dimensions given ("head and body 3 inches; tail 2") apply to no species of *Arvicola* with which we are acquainted.

The two specimens above enumerated (557, 559) from Prairie Mer Rouge, La., are the first ever quoted from the Gulf States, and are in fact the only Gulf specimens we have ever seen except *pinetorum*, and one example (No. 437, Calcasieu, La.) referred, with a shade of doubt, by Professor Baird to *Pedomys austerus*. They are both unusually rufescent, and one of them has the minimum length of tail (1.10 inches) we have seen in adults of this section of the genus; the skulls, however, show them



to be not *Pedomys*, and there is consequently little danger in referring them to *riparius*. If this determination be correct, the southward known range of the species is considerably extended.

In concluding this discussion of *Arvicola riparius*, we have a word of personal explanation. We sincerely trust that the manner in which we have conducted the investigation will be sufficient to relieve us of any possible charge of arbitrary or even injudicious rejection of many species that stood upon high authority. We began the study with a mind as free from preconceived ideas as possible; and, if we had any bias of judgment, it was a prejudice in favor of the validity of the species that were recognized in 1857. At one stage of our study, we had already been forced to give up the idea that there were more than two species (*riparius* and *townsendi*) of this section in the United States, but still believed in the possibility of defining several geographical varieties that might be properly recognized by name. Final examination, however, of the subject, with facilities, in the immense and unparalleled amount of material, never before enjoyed by any naturalist, has satisfied us that it is impossible to diagnosticate even permanent varieties or geographical races. Even "breweri", which seemed a clear case of an insular variety, has proved to graduate into the average form; and we do not conceive that any good would result from retaining this, or any other of the names that have been proposed, in the system. We have no alternative, then, but to throw all the names together as indistinguishable synonyms of *riparius*. In 1857, many names, all doubtless supposed, by their several proposers, to indicate valid species, were either formally or virtually suppressed; and a further reduction of eight is simply an advance, *pari passu*, with the increase of our knowledge on the subject. We trust that we have proven the position we take, and that we have seen the last of nominal species based upon the endless variations of *Arvicola riparius*.

#### ARVICOLA (MYONOMES) TOWNSENDI, Bachman.

##### Townsend's Meadow Mouse.

*Arvicola townsendi*, BACHMAN, Jour. Acad. Nat. Sci. Phila. viii, 1839, 60; Townsend's Narr. 1839, 315.—WAGNER, Wiegmann's Archiv, 1843, (11), 53.—AUD. & BACH. Q. N. A. III, 1863, 209, pl. cxliv, fig. 1.—BAIRD, M. N. A. 1857, 697.—NEWBERRY, P. R. R. Rep. vi, 1867, Zool., 61.—COOPER & SUCKLEY, Nat. Hist. Wash. Terr. 1860, 129.  
*Arvicola (Myonomes) townsendi*, COUES, Proc. Acad. Nat. Sci. Phila. 1874, 190.

DIAGNOSIS.—*Arvicola staturâ inter majores, longitudine trunci 5-6 poll., capitis sesquipoll., caudæ 2½-poll., pedis 1-poll., manus fere ½-poll.; auriculis*



*magnis, paululum vellere exstantibus; supra fulvo-badius, intus nigro permixtus, infra o griseo-brunneo albescens.*

HABITAT.—Oregon and Washington Territories (Columbia River, July 21, 1835, *Townsend*; the type. Puget Sound and Shoalwater Bay, *Cooper and Suckley*. Cascade Mountains, *Newberry*).

One of the larger meadow mice, 5 or 6 inches long, head  $1\frac{1}{2}$ , tail  $2\frac{1}{2}$ , hind foot 1, fore foot nearly  $\frac{1}{2}$ , ears nearly  $\frac{1}{4}$  high and as much or more wide, projecting a little from the fur; color above blended yellowish-brown and black; below whitish, shaded with grayish-brown.

TABLE XLVII.—Measurements of eighteen specimens of *A. TOWNSENDI*, both dry and alcoholic.

Number.	Locality.	Collector.	Nose to—				Tail to—				Remarks.
			Eye.	Ear.	Occiput.	Tail.	Vert.	Hair.	Fore foot.	Hind foot.	
1151	Shoalwater Bay	J. G. Cooper				5.50	2.15	2.45	0.45	1.05	Dry.
590	do	do				5.00	2.20	2.45	0.50	1.00	do.
1298	do	do				5.50	2.30	2.50	0.50	1.00	do.
2306	Puget Sound	G. Suckley				6.00	2.30	2.50	0.45	1.00	do.
	Straits of Fuca	do				5.97	2.58	2.68	0.56	1.18	Fresh.*
3177	Simlahmoo	C. B. R. Kennerly				4.75	1.70	2.10	0.44	0.88	Dry.
5098	Puget Sound	do	0.58	1.03	1.98	4.95	1.75	2.00	0.45	0.98	Alcoholic.
5095	do	do	0.59	1.10	1.36	5.25	2.38	2.45	0.50	0.95	do.
5099	do	do	0.57	1.25	1.40	5.10	2.00	2.25	0.58	1.00	do.
5030	do	do	0.53	1.10	1.48	5.25	2.40	2.80	0.44	0.95	do.
15038	do	do	0.50	1.10	1.25	4.35	2.25	2.65	0.48	0.98	do.†
9001	Columbia River	do									Alcoholic; young.
10015	do	do									do.
10016	do	do				4.25	2.30	2.50		0.90	Alcoholic.
10017	do	do				4.35	2.10	2.25		0.88	do.
10018	do	do				4.25	2.20	2.35		0.75	do.
10019	do	do				4.30	2.40	2.60		0.90	do.
10020	do	do				3.75	1.90	2.10		0.74	do.
10021	do	do				3.75	2.00	2.30		0.78	do.
11273	Cascade Mountains	J. S. Newberry				5.25	1.75	2.00		1.00	Dry.

\* Measurements copied from Suckley, *op. cit.*; specimen not seen.

† This specimen (since skinned out of alcohol) is about the longest-tailed American *Arvicola* we ever saw and has given us some anxiety. It is small for *townsendi*, with feet at a minimum and lacking a peculiar robustness those of *townsendi* generally show; the ear likewise is remarkably small. But we can make no other disposition of the specimen.

NOTE.—As will be seen from the figures, the Columbia River series, some of which, at least, appear full grown, are not larger than ordinary *riparius*, and it is mainly on account of the great comparative length of the tail that we assign them here. They offer a gentle transition into ordinary *riparius*. No. 1273, as elsewhere noted, is still more doubtful; it has the tail as short as is usual in *riparius*, but the feet beyond the maximum of ordinary *riparius*—exactly the reverse conditions of the Columbia River series.

DESCRIPTION (of No. 1151).—In form, this animal does not differ from other species of this section of the genus; nearly the usual relative proportions of head, body, tail, and feet being exhibited. The tail, however, will certainly average longer than in *riparius*; for in specimens no larger than the latter, the tail averages at or beyond a maximum of *riparius*. This length

of tail is one of the strongest features of the supposed species. The ears appear to us rather larger every way in proportion. They are three-quarters of an inch long and half an inch wide, and obviously project a little (about 0.10) beyond the fur. This rather exceeds anything we have seen in the largest-eared "edax", and is positively beyond the limits of typical *riparius*, in which the ear rarely if ever overtops the fur. The character of the soles is the same as in *riparius*; there are six tubercles. The soles are very sparsely hairy, and this only about half-way to the base of the nearest toes, but are fringed with hairs their whole length, as usual. The fore feet, measured from the back of the palmar callosity,\* are a little less than half as long as the soles; from the wrist, three-fifths of the hind foot. The relative lengths of tail and body are as 1.00 : 0.45; that is, the tail is somewhat less than one-half the head and body. Its hairiness is on an average. The head is a little over one-fourth as long as the head and body together, and a little less than one-third the body alone. The whiskers are about as long as the head.

In color, there is little to distinguish it from an average *riparius*. The upper parts, however, are somewhat paler or clearer, owing to greater predominance of the yellowish-brown over the black. In the lighter-colored specimens of *riparius*, the shade is generally produced by a prevalence of bay rather than of this yellowish-brown of *townsendii*. The under parts are clearer than is usual in *riparius*, and have a brownish wash from the sides, while the middle line of the throat is nearly white; but these differences are barely appreciable. In this, as in all the allied species, there is a curious seeming difference in color, according to the position in which the specimen is viewed. If held with the muzzle toward the eye of the observer, the general shade is very dark, because the longer blackish hairs are chiefly seen; if the skin be turned the other way, so that these hairs are collectively foreshortened as much as possible, the general effect is yellowish-brown. There are no streaks or markings anywhere, except that sometimes the throat is quite decidedly whitish; in one specimen, in fact (No. 5026), there is a perfect white streak along the throat; the whiskers are black and whitish; the feet brown. The tail is blackish-brown, and nearly unicolor; that is, the under side is merely a little paler than the upper, and there is no dividing line. The terminal pencil of hairs is, on the contrary, white, almost exactly as in

\* We take this measurement thus throughout this memoir. This explains an apparent discrepancy between Reind's and our measurements of the fore foot; he taking it from the wrist-joint. His length of fore foot averages 0.61, exactly as we should make out in the same way.

No. 988 of *riparius*, from Racine, Wis., above mentioned. The incisors are yellow, as usual; the claws brownish-white.

There is not much difference in color in any of the specimens before us. No. 3177, however, has the under side of the tail decidedly whitish, with a pretty distinct dividing line; No. 2396, apparently a very old one, and the largest *Arvicola* we have seen from the United States, is noticeably darker than the rest, and more grizzly; the under parts are hoary-ash instead of ashy-white.

*Skull* (No.  $\frac{1}{111}$ ).—There is nothing diagnostic in the skull of this species, except its size, as compared with that of *riparius*. It measures, in length, 1.27, 0.71 in width of zygomata, 0.48 in height; the molar series is 0.80 long; the upper incisors project 0.25, the under 0.45; the condyle of lower jaw is over 0.90 from their tip. These dimensions, although not those of the largest animal before us, exceed the maximum we have found for United States *riparius*. Another specimen, however, measures only 1.10 by 0.67, thus coming within the limits of *riparius*. We should judge, however, that it would have grown something larger in time, since the evident sutures, &c., are not those of an old animal.

The dentition conforms strictly to the *riparius* type. The back upper molar shows the anterior spherical triangle and two exterior and one interior closed triangles; the latter much larger than either of the others. The posterior trefle or crescent differs appreciably on the right and left sides; but for either may be described as a long crescent, having the regularity of its convexity somewhat interrupted by bulging, simulating another external angle, and bearing upon the back part of its concavity a long curved spur that simulates a second little crescent lying on the belly of the first. The middle upper molar has an anterior triangle a little obliquely placed, then an external closed triangle, then an internal similar, and then a postero-external one. The front upper molar is exactly like the middle one, with an additional internal closed triangle. Thus there are altogether ten external angles in the series, counting the bulging upon the back of the crescent as one; and nine internal ones, counting the spur on the belly of the crescent. Both these counts exclude the back horn of the crescent, which is directly posterior. No.  $\frac{1}{111}$  only differs slightly in the details of the crescent, in lacking the bulging upon its back. The back upper molar of another specimen is exactly like many samples of *riparius*. There is nothing to detain us in the under series.

When we began to look up *A. townsendi*, we anticipated no difficulty in making it out specifically distinct from ordinary *riparius*; but even with very little material to work up, we are fairly drawn to the opposite conclusion. In fact, the only tangible difference we can make out is that *townsendii* is larger, with a longer tail on an average; and even this is not constant, for several, out of our few specimens, exceed *average riparius* but little, or not at all, and come well within the limits of *riparius*. Still these specimens might have grown a little larger, and the average of the series stand at the extreme limit of *riparius*, while their tails and ears exceed this limit. We therefore feel justified in retaining the name *townsendi* as expressive of a geographical differentiation, occurring in a particular locality, to the apparent exclusion of the usual United States exponent of the subgenus. It is not at all a reliable species, and one of its strongest features—length of tail—reminds us forcibly of the case of *Hesperomys "boylii"* from the same localities; while the Columbia River series affords direct passage into *riparius*.

We have taken some pains to inform ourselves respecting the variation in size of the common large European species of the genus *Arvicola amphibius*, the well-known water-rat; and we find that all the variability we claim for *riparius*, and even for the Arctic forms of that species (as we shall presently see), sinks into insignificance beside the variations known to, and admitted by, all the better-informed writers in the case of *A. amphibius*.

The propriety of sinking *A. townsendii* to a mere variety of *riparius* will appear in still stronger light when we have dealt with Arctic animals of this subgenus full seven inches long. We take up this question next.

*Discussion of the Arctic ARVICOLÆ of the RIPARIUS type.*

The United States variations of *A. riparius* are disposed of easily in comparison with the intricacies of the Arctic material, respecting which some general observations will be offered.

Although we have handled a far larger number of these animals than has ever before been examined by all other investigators put together, yet, perhaps for the very reason that we have seen so many specimens, we are still unprepared to make identifications without reserve. Nor can we determine with certainty all of Richardson's supposed species, after careful study of his accounts, as well as of Audubon's and Bachman's supplementary notices, and although we have been favored by Dr. Solater with additional

information respecting Richardson's types, now in the British museum. The case appears to stand thus:—

Richardson says (F. B.-A. i. p. ) that "five species are common in the Hudson's Bay regions, exclusive of the lemmings". These, according to his views, are (1) "*riparius* Ord"; (2) "*xanthognathus* Leach"; (3) "*pennsylvanicus* Ord"; (4) "*noveboracensis* Raf."; and (5) "*borealis* Rich." Now there is no reasonable doubt that all five of these "common" species are represented in our immense series; but the difficulty is twofold. In the first place, it is to the last degree improbable that there are five species at all. Richardson's four lemmings have to be reduced to two, and there is no question that the grade of characters he sometimes employed to distinguish supposed species are utterly fallacious. Next, whatever the true number may be, we cannot make out, from Richardson's descriptions, which is which. This may seem strange, seeing the apparent minute detail of Richardson's descriptions; but, when we come to sift out his accounts, we find that three-fourths of all he says is generic (even ordinal) in character, and consequently pointless. Audubon's and Bachman's accounts are still more faulty in this respect; these gentlemen knew nothing about the animals they described except what they got from the Fauna Boreali-Americana. We will first expose the futility of what seem to be two strong points in these authors' accounts:—

Respecting his "*riparius* Ord" (afterward "*richardsonii* A. & B."), Richardson says that the "incisors are twice the size of those of *A. xanthognathus*, although the latter is the larger animal of the two". And regarding his "*borealis*", Richardson says:—"It is distinguished by the form of the thumb-nail" \* \* &c. Now, after examining hundreds of Arctic *Arvicolæ*, we have seen nothing of the sort in the matter of the incisors or of the nail, and must conclude that either we have not got hold of Richardson's animals, or else that there is some mistake about the alleged characters. The former supposition is untenable, for we have plenty of skins that show exactly all the other ascribed characters of "*riparius*" and "*borealis*". We therefore ignore these points altogether.

The "*noveboracensis*? Raf." of Richardson (afterward *drummondii* A. & B.) seems to be different from the rest, and perhaps does not belong to the *riparius* section at all. Professor Baird surmised that it might be a *Pedomys*, and we once rather inclined to the same opinion. It is described as having the "ears slightly overtopping the fur"; the "ventral aspect yellowish-gray"

("tinged with red"—A. & B.); "a slightly hairy scaly tail more than half the length of the head . . .  $1\frac{1}{2}$ " (according to A. & B. only 1.00); "above dark brown"; "head and body  $4\frac{1}{2}$ ", &c. Audubon's figure shows a brick-red animal all over, with an extraordinarily short tail. But the tints of his plates are thoroughly unreliable, and measurements of the type sent us by Dr. Scater are,—head and body 5.50, tail 1.50; while the same gentleman speaks of the color as "above, rather dark mouse-brown; beneath, much paler, *grayish*". Some of Richardson's expressions point to *Evotomys rutilus*, and, indeed, it seems almost impossible that he should not have included this abundant animal in checking off his five common species; but other characters assigned are totally incompatible. We should further remark that the ascribed length of the hind foot, 0.55, is less than we ever found for *any* species excepting the diminutive *A. oregonus*. We find it impossible to identify Richardson's "*noveboracensis*? Raf."

A. "*pennsylvanicus* Ord" is another of Richardson's species; it has usually been assigned to the ordinary *pennsylvanicus* of the United States (= *riparius*), and in all probability belongs there. He says it is "very abundant from Canada to Great Bear Lake", in which region we are prepared to show that the true *riparius* occurs; most of the puzzling specimens we shall presently treat of coming from extreme Arctic and Northwestern areas. It is true that Richardson puts the total length (" $3\frac{1}{2}$  inches") under average *riparius*; but this seems to be an error, for Dr. Scater's recent measurement of them shows 4.70, while there is certainly an error (probably typographical) in the ascribed length of head (" $2\frac{1}{2}$ "), for not even the biggest *xanthognathus*, 7 inches long, has such a head as this implies. On the whole, there is little risk of error in assigning Richardson's "*pennsylvanicus* Ord" as a complete synonym of true *riparius*. We will also bear in mind that Richardson states positively it is what Sabine described in Franklin's Journey under the (erroneous) name of *xanthognathus*.

Of a sixth species, less fully noticed by Richardson, from Bering's Straits, under name of *Arvicola rubricatus*, we know nothing. But we do not believe that this (or any other *Arvicola*) ever had the sides (or any other part of the body) "scarlet", as alleged, or even "nearly scarlet", as said by Audubon and Bachman. We believe, however, that this animal will prove to be an *Evotomys*, very near if not the same as *Mus rutilus* Pallas, with which Richardson has not shown himself acquainted, though we can not imagine how he overlooked it, as it appears he did.

With what light we have upon the subject at present, we make out the following case of Richardson's species:—

1. *A. "riparius" Ord* apud Rich. (= *richardsonii* Aud. & Bach.) is a transitional form between true *riparius* and *xanthognathus*, as fully treated of beyond. It has no peculiarities of incisive dentition.

2. *A. xanthognathus* Leach et Rich. is positively identified, as explained beyond.

3. *A. "pennsylvanicus" Ord* apud Rich. is a complete synonym of true *riparius*.

4. *A. "noveboracensis" Raf.* apud Rich. (= *drummondii* Aud. & Bach.) remains indeterminable. It may be a *Pedomys*.

5. *A. borealis* Rich. is a variety of *riparius*, as treated of beyond.

6. *A. rubricatus* Rich. is in all probability *Mus rutilus* Pall. (*Evotomys rutilus nobis*).

We are now better prepared to interrogate the specimens before us themselves, to which final appeal must of course be made. At the outset, we lay down two propositions, to be proven in the sequel.

I. All the specimens before us belong to the *riparius* section of *Arvicola* (= *Myonomes*).

II. Any characters which may be taken to establish two or more species are found to melt insensibly into those of typical *riparius*.

It is only at the close of an unusually protracted and laborious investigation that we venture upon this last extreme statement. We had throughout been perfectly satisfied of the specific validity of *xanthognathus* and *borealis*. Typical examples of each differ so much from ordinary United States *riparius* that we could not believe them to be the same, notwithstanding all these mice had taught us of the limits of variability in this family. We confidently labeled several hundred characteristic examples of *xanthognathus*, and a large number of specimens of *borealis* we disposed of with equal readiness. There still remained, however, over a hundred skins, the attempt to identify which upon the supposition of the specific validity of *xanthognathus* and *borealis* has involved us in utter confusion, from which we see no hope of escape except through abandoning our former position. It is, we see now more than ever before, this having to tabulate and label every individual specimen that tells the story and applies the crucial test.

It is in violation of our preconceived ideas to be obliged to identify such

an animal as No. 4504 (beyond) with No. 9235 (beyond), and both of them with *riparius*, as not specifically distinct; yet we can find no other alternative, since our series supplies every link in the chain. If we take dimensions, we find every intermediate size, by tenths of an inch, from three to eight inches; it is the same with proportions of feet, tail, and ears, both relative and absolute. Conditions of pelage are utterly confounding, even leaving season, if not also latitude, out of consideration. Those characteristic examples of *xanthognathus*, in which the chestnut cheek is well marked, set aside, color gives us nothing we can rely upon. If, therefore, there be more than one species in the series, I must simply confess that I am not bright enough to discover or define it.

In dealing with this lot of material, I shall, in the first place, eliminate the specimens not appreciably different in any respect from ordinary United States *riparius*. I will then separate those that have the chestnut cheek-patch (an easy matter) and label them *xanthognathus*, without reference to their being a variety only of *riparius*. I shall be able to label many of the rest var. *borealis*, and to indicate a considerable number as more or less nearly approaching either *xanthognathus* or *borealis*. But a large residuum (including most of the alcoholics, respecting which nicety of determination is obviously impossible) can be only marked as "*riparius* var.—?".

The distribution of *xanthognathus* and *borealis* will be perceived from the tables beyond. Southern and Central British American specimens, as a rule, are more or less completely similar to ordinary *riparius*. The extreme of *borealis* has only occurred, so far as we are aware, from the Arctic coast and contiguous northwestern regions. Well-characterized *xanthognathus* scatters over a larger area, but likewise focuses in the Northwest. It is a further source of difficulty and doubt that these extremes are not *geographically* marked; on the contrary, they occur side by side, and are, therefore, not explicable upon the rules of geographical variation that we have elsewhere laid down and somewhat successfully applied. This may be held as strong evidence that these forms are specifically distinct; but we must beg any one who may so believe to show us any reliable specific character.

The following table embraces a number of specimens more or less perfectly similar to ordinary *riparius*, not distinguishable in any way from that form, and not noticeably inclining to the characters of either var. *borealis* or var. *xanthognathus*. What slight discrepancies there are in average dimensions are noted at the conclusion of the table.



TABLE XLVIII.—Measurements of twenty-nine *s.* northern *ARVICOLE* of the *RIPARIUS* type, and not that species.

Number.	Sex.	Date.	Locality.	Collector.	Nose to—				Tail to end of—			Remarks.	
					Eye.	Ear.	Occiput.	Tail.	Vert.	Palma.	Solea.		
6446	..	July —, 1861	Fort Simpson .....	B. R. Ross .....	..	..	..	..	..	..	..	Dry.	
4548	♂	Apr. 30, 1860	do .....	do .....	0.45	1.05	1.30	4.70	1.05	1.15	0.31	Fresh, except feet.	
4549	♀	Mar. 30, 1860	do .....	do .....	0.50	1.05	1.30	4.35	1.35	1.35	0.35	Fresh.	
4550	♂	Apr. 26, 1860	do .....	do .....	0.50	0.95	1.30	4.45	1.15	1.25	0.35	do.	
4576	..	May 30, 1860	do .....	do .....	..	..	..	..	..	..	..	Suckling.	
4577	..	May 30, 1860	do .....	do .....	..	..	..	..	..	..	..	do.	
4578	..	May 30, 1860	do .....	do .....	..	..	..	..	..	..	..	do.	
10290	♀	May 10, 1860	do .....	do .....	..	..	..	..	..	..	..	do.	
2758	..	do .....	do .....	do .....	..	..	..	..	..	..	..	Young.	
4575	..	do .....	do .....	R. Kennicott .....	..	..	..	4.25	1.15	1.35	0.35	Dry.	
4567	♂	Sept. 6, 1858	do .....	do .....	0.55	1.05	1.3	1.50	1.6	1.75	0.32	Fresh, except feet.	
4568	♀	Sept. 16, 1858	do .....	do .....	0.50	0.95	1.0	1.10	1.5	1.75	0.35	Fresh; ear behind 0.42.	
4571	♀	Sept. 1, 1859	do .....	do .....	0.50	0.95	1.2	4.00	1.50	1.70	0.32	Fresh.	
4572	♂	Sept. 5, 1859	do .....	do .....	0.50	0.9	1.11	1.00	1.5	1.70	0.33	Fresh; ear 0.40.	
4573	♂	Sept. 16, 1859	do .....	do .....	0.45	0.95	1.07	3.50	1.55	1.75	0.30	Fresh; ear 0.42.	
4574	♀	Sept. 5, 1859	do .....	do .....	0.50	0.90	1.12	1.30	1.6	1.90	0.34	Fresh.	
4566	♀	Feb. 15, 1860	Fort Liard .....	do .....	..	..	..	1.25	1.50	1.6	1.75	0.35	Dry.
4569	♂	Oct. 3, 1859	do .....	do .....	0.52	0.96	1.16	1.30	..	0.35	0.75	Fresh, except feet.	
4570	♂	June 5, 1860	Winnethy River .....	do .....	0.55	1.00	1.22	4.50	..	0.31	0.73	do.	
..	..	..	Red River Settlement.	D. Gunn .....	..	..	..	4.25	1.4	1.60	0.34	Dry.	
..	..	..	do .....	do .....	..	..	..	1.20	1.35	1.55	0.31	do.	
..	..	..	do .....	do .....	..	..	..	1.30	1.5	1.50	0.33	do.	
..	..	..	do .....	do .....	..	..	..	1.75	1.3	1.50	0.32	do.	
3024	..	..	Nelson River .....	do .....	..	..	..	1.3	1.50	0.31	0.67	do.	
3025	..	..	do .....	do .....	..	..	..	4.00	1.00	1.10	0.30	do.	
3086	..	..	do .....	do .....	..	..	..	4.25	..	0.79	0.66	do.	
3621	..	..	Selkirk Settlement .....	do .....	..	..	..	4.25	1.1	1.2	0.35	do.	
3010	..	..	do .....	do .....	..	..	..	..	1.40	1.00	0.34	do.	
4163	..	..	Moose Factory .....	J. McKenzie .....	..	..	..	..	..	0.30	0.79	do.	
4360	..	..	do .....	C. Drexler .....	..	..	..	3.90	1.10	1.30	0.31	do.	
3560	..	..	Red River Settlement	R. Kennicott .....	..	..	..	4.00	1.2	1.35	0.33	Fresh, except feet.	
5154	..	..	Big Island .....	J. Reid .....	..	..	..	4.25	..	..	0.71	Dry.	
644	..	..	do .....	do .....	..	..	..	4.50	1.4	1.65	0.33	do.	
6845	..	..	do .....	do .....	..	..	..	4.00	1.0	1.40	0.70	do.	
6843	..	..	Fort Resolution .....	J. McKenzie .....	..	..	..	4.50	1.25	1.60	0.72	do.	
3745	..	..	Fort Rae .....	L. Clarke .....	..	..	..	..	..	..	..	do.	
3746	..	..	do .....	do .....	..	..	..	..	..	..	..	do.	
3750	..	..	do .....	do .....	..	..	..	..	..	..	..	do.	
3755	..	..	do .....	do .....	..	..	..	..	..	..	..	do.	
3756	..	..	do .....	do .....	..	..	..	..	..	..	..	do.	
3757	..	..	do .....	do .....	..	..	..	..	..	..	..	do.	
3776	..	..	do .....	do .....	..	..	..	..	..	..	..	do.	

It appears from the foregoing that the average of this series is nearly at the minimum of United States *riparius*, and that its maximum is at the average of ordinary *riparius*. The average tail (1.32) is below the smallest average of any of the United States series of *riparius* tabulated, while the average foot (0.71) is about at the minimum of the latter; only three feet,

indeed, of this series touch the average (0.79) of United States *riparius*, the rest being between 0.65 and 0.75; whereas the United States *riparius*' feet apparently never fall below 0.70, and may range from 0.80 to 0.90.

The following is an enumeration (we did not think it necessary to tabulate) of the specimens in the present series that depart more or less noticeably in some respects from ordinary *riparius*, yet do not show the peculiarities of either *borealis* or *xanthognathus* strongly enough to enable us to label them as belonging to either of those forms. We shall simply label them "*riparius* var.—?". In general, their absolute size is neither above nor below that of *riparius*; few being so small as those we tabulate beyond under head of *borealis*, and none being as large as the doubtful *xanthognathus* beyond given. They differ from ordinary *riparius* principally, as would be expected in these boreal cases, in their smaller members and heavier pelage.

Nos. 6847, 6849, 6850, 6851, 6855, 6857, 6858, 6859, 6861, 6864, 6866, 6867, 6870, 6872, 6873, all collected by Mr. Kennicott on the Yukon, at the mouth of Porcupine River. They run directly into the specimens from the same locality, tabulated beyond as *borealis*.

Nos. 6832, 6881, 6882, 6876, 6889, 6887, 6884, 6885, 6886, 6883, 6888, 6880, taken by the same explorer in spring, two hundred miles southwest of the last-named locality. Owing to the season, they average remarkably dark-colored.

Nos. 9157, 9156, 9151, 9152, 9158, 9160, 9164, 9174, 9167, 9159, 9149, 9144, 9142, 9161, 9148, 9165, 9150, 9166, 8022, 8025, 8026, 8163, 8755. Fort Anderson, north of Great Bear Lake; R. McFarlane.

Nos. 6836, 6937, 6841, 5749, 9194, 6849, 6834, 6839, 9193, 9114, from Anderson River; R. McFarlane. Some of these, as 6841, run very close to certain styles of *xanthognathus*.

Nos. 9109, 9122, 8820, 9213, 9205, 9126, 9101, 9187, 9127, 9123, 9206, 9130, 9217. This lot was received by Mr. McFarlane from the Esquimaux of McKenzie's River, and is less homogeneous than either of the preceding.

Nos. 8037, 8027, 8041, 8031, 8045, 8032, 8040, 8050, 8029, 8052, 8038, 8049, 8043, 8054, 8042, 8045, 8044, 8030, 8046, 8039, 8034, 8036, 8035, 8028, 8053. From the Arctic coast, brought by Esquimaux to Mr. McFarlane.

## † ARVICOLA RIPARIUS VAR. BOREALIS, Rich.

## Little Northern Meadow Mouse.

*Arvicola borealis*, RICHARDSON, Zool. Journ. 1828, 517; Fu. Bor.-Am. I, 1829, 127.—AUD. & BACH., Q. N. A. III, 1853, 134, pl. 129 (from Richardson).—BAIRD, M. N. A. 1857, 549 (from the same).

"*Hypodacus borealis*, WAGNER, Suppl. Schreber, III, 1843, 503" (the same).

*Arvicola* (*riparius* var. †) *borealis*, COUES, Proc. Acad. Nat. Sci. Phila. 1874, 190.

DIAGNOSIS.—*A. riparius similimus*, sed minor, artubus brevioribus, hirsutioribus, vellere lanuginosiore.

Averaging a little smaller than true *riparius* (three or four inches long), with smaller and hairier ears, tail, and feet.

HABITAT.—Northwestern America.

TABLE XLIX.—Measurements of thirty-one small Arctic ARVICOLÆ of the RIPARIUS type, supposed to represent a variety BOREALIS, Rich.

N. B.—They connect directly with specimens of the preceding enumeration.

Number.	Locality.	Collector.	Nose to—				Tail to end of—		Fore foot.	Hind foot.	Ears.	Remarks.
			Eye.	Ear.	Occiput.	Tail.	Vert.	Hair.				
9181	Liverpool Bay .....	R. McFarlane .....				3.60	1.10	1.50	0.33	0.66		Dry.
*9139	do .....	do .....					0.75	1.00	0.32	0.70		do.
8033	Arctic coast .....	do .....				3.50	0.80	1.05	0.33	0.70	0.37	do.
8047	do .....	do .....				3.50	1.00	1.30	0.33	0.70		do.
9138	do .....	do .....	0.43	0.98	1.03	3.50			0.34	0.71	0.35	do.
9204	McKensie River .....	do .....				3.75	1.00	1.30	0.35	0.74		do.
9137	do .....	do .....				3.10	0.70	1.00	0.33	0.71		do.
9140	do .....	do .....				3.00	0.60	1.15	0.32	0.73	0.34	do.
6874	do .....	R. Kennicott .....								0.73	0.34	do.
9107	Anderson River .....	R. McFarlane .....				3.00	0.80	1.05	0.30	0.68		do.
9179	do .....	do .....				3.50	0.90	1.15	0.33	0.71	0.36	do.
8165	do .....	do .....				3.00	0.90	1.15	0.34	0.73	0.38	do.
9035	do .....	do .....				2.75	1.00	1.00	0.39	0.71	0.33	do.
9177	Fort Anderson .....	do .....					0.90	1.15				do.
9190	do .....	do .....								0.70		do.
6865	Yukon River .....	R. Kennicott .....	0.50	0.85	1.08	3.00	0.90	1.10	0.39	0.71	0.37	do.
6860	do .....	do .....								0.70		do.
6868	do .....	do .....	0.60	1.05	1.28	4.40	1.50	1.99		0.75	0.40	Fresh.
6863	do .....	do .....								0.73		Dry.
6869	do .....	do .....				1.18	4.30	1.40	1.58	0.35	0.75	Fresh.
6860	do .....	do .....					3.50			0.70		Dry.
6854	do .....	do .....					3.50			0.78		do.
6956	do .....	do .....	0.59	0.75	1.05	3.80	1.25	1.60	0.49	0.72	0.35	Fresh.
6850	do .....	do .....				3.75	0.90	1.30	0.39	0.70		Dry.
6871	do .....	do .....	0.30	1.05	1.18	4.35	1.15	1.45				Fresh.
16848	do .....	J. Lockhardt .....	0.54	1.03	1.16	4.65	1.60	1.93		0.75	0.35	do.
6879	300 miles S.W. of Yukon	R. Kennicott .....	0.45		1.05	3.25			0.30	0.66	0.40	
6877	do .....	do .....				3.75	1.00	1.25	0.31	0.68	0.35	
6853	Yukon .....	do .....										Young.
6854	do .....	do .....				3.40				0.75		Dry.
8792	do .....	Struchan Jones .....				3.50	1.10	1.30		0.68		

\* Taken in winter, and apparently adult. Its length cannot now be ascertained with accuracy; but it is a tiny animal, apparently falling short of 3 inches.

† Contained 7 fetuses. This and the others measured fresh do not appear to be so much larger than the rest as the figures would indicate.

The figures of this series are believed to be approximately correct, though not quite accurate. They indicate an animal at or below the minimum of ordinary *riparius*, with members, especially the tail, below the minimum; the feet, however, do not differ quite so much, being fully within the minimum of *riparius*, and, in fact, averaging *over* the dimensions of the average foot of the last table presented, and decidedly exceeding the dimensions assigned by Audubon (0.63). As to the form of the thumb-nail, we cannot make out anything at all peculiar. In furriness of pelage, some of these specimens quite come up to the mark of *borealis* as described. Thus, No. 9235 has the fur on the back fully ten-twelfths of an inch long; and the hair about the lips is so long as to droop over the whole length of the upper incisors, completely hiding them. Then, again, the soles, however, are not nearly so hairy as some other specimens we have seen; the soles of this same 9235 being completely naked from the posterior tubercle. These longest-haired specimens, it should be observed, are all in winter pelage; spring and summer examples have the fur scarcely, if at all, longer than ordinary Pennsylvania or Massachusetts skins.

Different as many of these little creatures look from typical *riparius*, or from the big ones with which they are associated, it is impossible for us to regard them as specifically distinct.

#### ARVICOLA (MYONOMES) XANTHOGNATHUS, Leach.

##### Chestnut-Cheeked Meadow Mouse.

*Arvicola xanthognathus*, LEACH, Zool. Miscel. i, 1814, 60, pl. 28.—RICHARDSON, F. B.-A. i, 1829, 122.—AUD. & BACH. Q. N. A. iii, 1853, 67, pl. 125.—BAIRD, M. N. A. 1867, 552.—DALL, Alaska and its Resources, 1870, 577. (Whether of SABINE? Not of any author treating of United States species.)  
*Arvicola (Myonomes) xanthognathus*, COUES, Proc. Acad. Nat. Sci. Phila. 1874, 190.

DIAGN.—*Arvicola staturâ inter maximas, buccis castaneis.*

One of the largest meadow mice, with chestnut cheeks; 5 to 8 inches long; tail 1 or 2; hind foot 0.85 to 1.05; ear  $\frac{1}{2}$  to  $\frac{3}{4}$ .

HABITAT.—North America, north of the United States.

DESCRIPTION (No. 4504, Fort Resolution, Great Slave Lake).—This is one of the largest American *Arvicola* we have ever handled; it measured  $6\frac{1}{2}$  inches long when fresh, and the skin indicates a stout, bulky animal. The tail is shorter in proportion than in average *riparius*; it is said to have been 2.25 when fresh, but is now just about 2.00; its hairiness is of medium amount.

The soles are over an inch long, and thoroughly furry as far as the posterior tubercle; naked in the rest of their length. There are six conspicuous tubercles, as usual in this section: a posterior one at base of hallux; two at base of outer toe; one at base of second toe; and one at bases of third and fourth toes. The fore feet are comparatively small, being obviously less than half the hind (measured from the posterior tubercle). There are five palmar tubercles: one representing the "ball" of the rudimentary thumb, which bears a minute abortive nail; another just beside and external to the first; one at the base of each lateral finger; and one at the bases of the two central fingers. The relative proportions of all the ten digits is as usual in this section. The ears are moderate for the size of the animal, measuring a little over half an inch high and wide; they overtop the fur a little, are well furred both sides, rounded in shape, and with a highly-developed antitragus fully occluding the meatus. The fur, much as in other Arctic *Arvicola*, is longer, thicker, and softer than that of United States species; and, although the reverse of harsh, has very little lustre, apparently owing to the less admixture of the long, glossy, bristle-like hairs that occur so abundantly in southern samples, especially of maritime or very wet places. The longest whiskers about equal the head; others are much shorter.

In color, this animal represents one of the few species, that may usually be known at a glance, and the only one of ours that has bright tints in sharply restricted areas. *The cheeks are bright chestnut*,\* in marked contrast with surrounding shades. The extreme muzzle is blackish, and thence to over the eyes a dusky shade prevails. In some specimens, there is a small rusty or yellowish-brown orbital space, and there is generally a perceptible shade of the same on the auricular region, though we have never appreciated so much of this as Audubon's smaller figure shows. The upper parts are of an intimate mixture or "grizzle" of yellowish-brown, gray, and black, somewhat darkest along the middle line of the back, and brightest on the haunches, but not noticeably far from uniform all over. The resulting shade is *generally* lighter or more yellowish-brownish-gray than in southern species, owing to smaller proportion of long dark hairs. The tail is bicolor, but not very sharply so—more so in some specimens than in others; the feet are fuscous.

\* The name "xanthognatha", "yellow"-checked, and the descriptions of authors, as "yellow", "orange brown", "fulvous", &c., do not correctly indicate the color as it appears to our eyes. We can see nothing but a bright bay or chestnut, and the shade scarcely varies appreciably in any of the specimens examined in which it is evident at all.

The under parts are uniformly strong hoary-ash, owing to whitish tips of the very deep plumbeous fur. The hoariness varies much, sometimes being scarcely evident, and at other times being soiled with a brownish or clay-colored wash. The very edges of the lips are apt to be whitish; the whiskers are whitish and dark; the incisors yellow, the upper generally deepest-tinted, the under frequently nearly white.

We will finish consideration of *color* before taking up the matter of the measurements. Our remarks are based upon an examination of several hundred specimens.

The range of individual variation appears to us comparatively slight. This is probably due to the rather homogeneous character of the localities whence our specimens came. Some are a little darker, or a little lighter, browner, grayer, more grizzly, &c., than others. But we see nothing that calls for special remark in this connection. One (No. 3594) is an incomplete albino, having a broad zone of pure white around the head and neck, thence extending along the breast and belly, and flesh-colored ears.

Certain seasonal conditions of pelage are strongly marked. In the spring, just after the animal has shed its old winter coat, it appears in a fur very noticeably shorter, finer, smoother, and glossier than it is at other seasons; and the color is so different as to readily suggest specific distinction to one ignorant of the facts in the case. At a little distance, the animal looks almost black, so dark is the shade. The brown of the upper parts is almost a blackish mahogany-color, with little or no admixture of fulvous, tawny, or yellowish-brown, while the plumbeous below has corresponding intensity and is but slightly hoary. The tail is nearly unicolor. As the season advances, the depth of color insensibly lessens; the grayest and grizzliest animals are those that wear the oldest pelage in the fall and winter. But we do not notice, in these or other changes, any marked difference in the cheeks, the distinctive brand of the species usually remaining much the same.

On the other hand, individual variations in *size* are as great as we have succeeded in demonstrating for *riparius* with our immense array of specimens from all localities; and this is the more remarkable, seeing that *xanthognathus* is so restricted in its geographical distribution that climatological influences are hardly brought to bear upon it. We invite particular attention to the subjoined table that demonstrates the variability we continually insist upon

in this memoir. *Some specimens are little more than half as long as others*, and certainly have less than half the bulk. Our figures for apparently mature animals run from 4.50 to 8 inches for length of trunk. Now, to keep largely within bounds, we will strike off half an inch each way, and say a normal limit of variation is between 5 and  $7\frac{1}{2}$  inches: this  $2\frac{1}{2}$  inches is 50 per cent. of the minimum and 40 per cent. of the mean length of the animal. This great discrepancy is the more instructive, because in the case of *xanthognathus* there is no possible question of specific identity of the largest and smallest specimens. In some other cases, where reputed nominal species, based in part on dimensions, were at issue, we may possibly be suspected of granting improbable and undue range of variation. But here the matter is brought to a focus: we show, in the specimens of unquestionably a single species, as great variability in size as we have anywhere attempted to prove.

And yet this difference is no greater than we believe is well known to occur in other species of the genus, notably the *Arvicola amphibius* of Europe. No one is surprised to kill two house-rats, one of which is twice as big as the other. We hold that a corresponding variability is as normal to some purely feral animals as to the semi-domesticated species just cited; and we believe that it argues a progressive increase in size, with age, over the stature ordinarily reached at the period of puberty—that is to say, a *Mus* or an *Arvicola* may be “adult” or “mature” in the sense that it has lost the signs of youth, gained those of adult life, and become capable of reproduction, and yet, after this, may increase in length by one-third at least, and double its bulk in the subsequent years of its life.

Recurring again to our measurements, we next observe that the tail of this animal (taking it to the end of the vertebræ as a more constant and reliable measurement than to the tip of the hairs) ranges from 0.75 to 2.25, as the figures stand! and, making large allowance for erroneous elements, we may safely say that the tail is “*an inch or two*” long, *i. e.*, it varies 100 per cent. of the minimum! What could more forcibly illustrate the instability that attends the dimensions of organs produced in any sense as matters of vegetative repetition? The measurements of other parts need not detain us. For several reasons, among them ease of correct measurement, the limits of the figures for the feet and ears do not stand quite so far apart as those for the body and tail do; they coincide with the results of our measurements

of other species. The soles run from 0.85 to 1.05—say from 0.40 to 1.00—as an ordinary range; and it should be observed that the smallest specimens, as Nos. 4509, 4510, 6558, &c., have feet quite up to average dimensions.

Our table is drawn up to show the different localities represented in our immense series of specimens; but otherwise the skins were picked out at random from the box containing several hundred till we had tabulated enough to answer our purpose.

TABLE L.—Measurements of sixty-nine specimens of *ARVICOLA XANTHOGNATHUS* from North America north of the United States.

Number.	Sex.	Locality.	Collector.	Nose to—				Tail to end of—				Remarks.
				Eye.	Ear.	Outlet.	Tail.	Vertebra.	Hairs.	Fore feet.	Hind feet.	
6306		Fort Good Hope .....	R. Kennicott .....								0.95	Alcoholic.
3023		Nelson River, Hud- son's Bay Territory.	D. Gunn .....				7.00	1.60	1.45	0.40	0.90	Dry.
6541		Big Island, Great Slave Lake.	J. Held .....				5.25	1.30	1.35		0.90	do.
5726		Great Slave Lake .....	N. Taylor .....				5.75	1.30	1.40		0.90	do.
8356		Fort Churchill .....	W. Macfarlane .....	0.60	1.30	1.60	5.50	1.75	2.10	0.54	1.00	Alcoholic.
5727		Buffalo River, Great Slave Lake.	R. R. Ross .....				5.50	1.30	1.55		0.90	Dry.
5730		do .....	do .....				6.10	1.90	2.15		0.95	do.
6541		Fort Resolution, Great Slave Lake.	do .....				5.25	1.50	1.75		0.95	do.
4504	♀	do .....	do .....	0.75	1.40	1.50	6.50	2.35	2.50	0.45	1.05	Fresh.
4506	♀	do .....	do .....	0.70	1.35	1.48	6.00	2.00	2.25	0.40	0.95	do.
4503	♀	do .....	do .....	0.75	1.30	1.37	5.75	2.10	2.35	0.48	1.02	do.
7703		do .....	do .....	0.70	1.35	1.70	6.50	2.00	2.25	0.60	1.05	Alcoholic.
5735		Fort Liard .....	W. L. Hareley .....								0.98	Dry.
5751		do .....	do .....					1.00	1.10		0.87	do.
5732		do .....	do .....								0.92	do.
5734		do .....	do .....					1.00	1.30		0.85	do.
5740		do .....	do .....					1.25	1.45		0.98	do.
5742		do .....	do .....					0.75	0.10		0.85	do.
5736		do .....	do .....					0.75	1.00		0.95	do.
5739		do .....	do .....					1.25	1.50		0.95	do.
6942		Lapierre, Rocky Mount- ains.	J. Flett .....				6.50	2.00	2.40	0.45	0.98	do.
7061		Fort McPherson .....	C. P. Gandet .....				6.50	1.90	2.10		1.04	do.
7064		do .....	do .....				5.75	1.00	1.85	0.40	0.92	do.
7065		do .....	do .....				5.75	1.60	1.80	0.42	0.97	do.
7188		do .....	do .....				7.00	1.80	2.20	0.44	0.98	do.
7063		do .....	do .....				5.50	1.20	1.30		0.92	do.
7070		do .....	do .....				5.50	1.00	1.10		0.93	do.
9619		Nowkhak .....	W. H. Dall .....				6.00	1.75	2.05		0.94	do.
9962		do .....	do .....				5.75	1.60	1.80		0.90	do.
9603		do .....	do .....				5.50	1.75	2.00		0.98	do.
9977		do .....	do .....				5.00	1.80	2.05		0.90	do.
9414		do .....	do .....				5.00	1.80	1.80		0.93	do.

\* Skin 4500; much stretched.



TABLE 11.—Measurements of sixty-nine specimens of *ARVICOLA XANTHOGNATHUS* from North America north of the United States—Continued.

Number.	Sex.	Locality.	Collector.	Nose to—				Tail to end of—		Fore foot.	Hind foot.	Ear.	Remarks.
				Eye.	Ear.	Occiput.	Tail.	Vertebrae.	Hind.				
8969	...	Nowkhak	W. H. Dall	...	...	...	5.00	1.75	2.00	...	0.91	...	Dry.
9418	...	do	do	...	...	...	...	1.30	1.50	...	1.00	...	do.
8970	...	Fort Anderson	E. McFarlane	...	...	...	5.75	1.63	1.33	0.40	0.97	...	do.
9106	...	do	do	...	...	...	5.00	1.30	1.45	0.40	0.90	...	do.
8975	...	do	do	...	...	...	5.00	1.10	1.30	...	0.65	...	do.
8973	...	do	do	...	...	...	5.00	1.30	1.50	...	0.93	...	do.
8975	...	do	do	...	...	...	4.75	1.93	1.45	...	0.97	...	do.
8968	...	do	do	...	...	...	...	1.50	1.00	...	0.90	...	do.
8969	...	do	do	...	...	...	6.00	1.40	1.65	...	0.95	...	do.
8974	...	do	do	...	...	...	5.10	1.50	1.40	...	0.86	...	do.
2395	...	do	do	0.50	1.15	1.30	4.00	1.30	1.40	0.45	0.99	0.56	Alcoholic.
6633	...	Anderson River	do	...	...	...	5.30	1.85	1.50	...	0.95	...	Dry.
8971	...	Latitude 67° north	do	...	...	...	5.00	1.60	1.30	...	0.99	...	do.
4509	...	Liard River	R. Kennicott	0.60	1.10	1.25	4.90	1.75	1.95	0.49	0.96	0.55	Fresh.
4510	...	do	do	0.68	1.10	1.30	4.50	1.50	1.70	0.37	0.90	0.55	do.
7106	...	do	do	...	...	...	...	...	...	...	1.00	...	Alcoholic.
6754	...	Yukon River	do	...	...	...	7.50	1.10	1.00	0.48	0.96	0.65	Dry.
6674	...	do	do	...	...	...	7.25	1.80	2.15	0.41	0.97	0.78	do.
6684	...	do	do	...	...	...	6.85	1.60	1.90	0.40	0.93	0.68	do.
6764	...	do	do	...	...	...	7.50	1.35	1.85	0.48	0.96	0.50	do.
6771	...	do	do	...	...	...	6.00	1.60	1.80	0.41	0.94	0.60	do.
6570	...	do	do	0.60	...	...	6.50	1.50	1.80	0.40	0.98	0.67	do.
6574	...	do	do	...	...	...	6.25	1.90	1.45	0.44	0.75	0.60	do.
6763	...	do	do	...	...	...	6.51	1.40	1.60	0.44	0.96	0.60	do.
6666	...	do	do	...	...	...	8.00	1.10	2.15	0.47	0.94	0.65	do.
6739	...	do	do	...	...	...	7.75	1.00	2.15	0.44	0.99	0.66	do.
6647	...	do	do	...	...	...	8.00	1.60	2.10	...	0.95	0.64	do.
6554	...	do	do	...	...	...	7.25	2.00	2.25	...	0.94	0.75	do.
6734	...	do	do	...	...	...	6.50	1.60	1.30	...	0.96	0.56	do.
6541	...	do	do	...	...	...	7.00	1.50	1.90	...	0.75	...	do.
6688	...	do	do	...	...	...	6.00	1.40	1.75	...	0.98	0.57	do.
6751	...	do	do	...	...	...	6.00	1.35	1.60	...	0.97	0.61	do.
6549	...	do	do	...	...	...	7.10	1.70	1.95	...	0.96	0.62	do.
6437	...	do	do	...	...	...	8.00	1.90	2.15	...	1.00	0.70	do.
6788	...	do	do	...	...	...	7.25	1.60	1.95	...	0.93	...	do.
6570	...	do	do	...	...	...	6.25	1.15	1.45	...	0.97	...	do.
6556	...	do	do	...	...	...	5.75	1.50	1.60	...	0.90	0.53	do.
6698	...	do	do	...	...	...	7.75	1.60	1.65	...	0.97	0.65	do.
6799	...	do	do	...	...	...	8.00	1.30	1.50	...	0.94	...	do.
6573	...	do	do	...	...	...	5.25	1.40	1.75	...	0.86	0.62	do.
6558	...	do	do	...	...	...	4.75	...	...	...	0.90	0.59	do.

NOTE.—Mr. Kennicott's specimens were partly taken at Fort Yukon (mouth of Porcupine River) and partly 300 miles southwest of this locality. Besides those tabulated, we have examined several hundred others, all brought from the same region by Mr. Kennicott.

Fortunately, the synonymy of this species is plain. It was first described and not very well figured by Leach, as above; Dr. Richardson next noticed it in a more satisfactory detail; then Audubon and Bachman reproduced the sense of Richardson's article; and, lastly, Baird published it upon substantially

the same grounds, though he only admitted it among the hypothetical species of his great work. But there is no evidence that the species has occurred in the United States, and that it ever does so is highly improbable; and consequently all the citations of "xanthognathus" from this country—those of Godman, Harlan, Say, DeKay, Linsley, and others—are referable only to *riparius*. We have not seen Sabine's article, where the name appears; but Richardson says positively that Sabine's "xanthognatha" is not this animal at all, but is what he (Richardson) calls "*pennsylvanica* Ord" (see under Arctic *riparius* in this memoir). We are equally in the dark respecting the "*Cam-pagnol aux joues fauves*" of Desmarest, which Godman, for instance, refers to his "xanthognatha" (= *riparius*), but which Audubon and Bachman cite as true *xanthognathus*. Audubon and Bachman have blundered in citing "*xanthognathus* Harlan and Godman"; but it seems to have been a mere slip of the pen, for they expressly state on a subsequent page that Harlan's and Godman's animal cannot be the true *xanthognathus*.

This *Arvicola* appears to inhabit most of British and Russian America. Audubon and Bachman say they took it in Labrador; Leach got his from Hudson's Bay; and we have other rather easterly quotations at hand. But the creature seems to be especially abundant and characteristic northwardly, as in the region of the Mackenzie, Anderson, and Yukon Rivers.

NOTE.—We have a great many skulls of this animal before us, but it seems not worth while to tabulate them, as they show nothing whatever different from those of *riparius*, excepting a somewhat larger size; all the proportions are the same. Even the increase in size is only evident on striking averages, since the smaller skulls reach well into the dimensions of the larger examples of *riparius*. The skulls run in total length, 1.15 to 1.30; in width of zygomatic arches, up to about 0.75; in height, upward of 0.50; at the interorbital constriction, 0.15 or 0.20; length of molar series, 0.25 or 0.30; length of lower jaw from tip of incisor to back of condyle, nearly an inch; to tip of coronoid, about 0.75; the under incisors are 0.30 or 0.40 long from the alveoli; the upper have the ordinary relative size.

The dentition of this species is strictly that of the *riparius* group, and, in fact, so far as we can see, identical with that of *A. riparius*. There are the usual variations in the form of the back upper molar, which, however, always shows its crescent and two external lateral triangles; while the front under molar has, as in *riparius*, the maximum number of lateral triangles, owing to the far advance of the median zigzag line of enamel.

†*ARVICOLA RICHARDSONI* of Aud. & Bach.

## Large Northern Meadow Mouse.

*"Arvicola riparius* ORD", apud RICHARDSON, Fb. Bor.-Am. 1899, i, 120. (Not of Ord.)*Arvicola richardsoni*, DEKAY, N. Y. Zool. i, 1842, 91.—AUD. & BACH., Q. N. A. 1853, iii, 163, pl. cxxxv, f. 1 (based on Richardson's animal).—BAIRD, M. N. A. 1857, 551 (same as the foregoing).

Selecting a number of the very largest skins in the collection, we can see that they noticeably surpass the average of United States *riparius*, and stand at, if not beyond, the maximum of the latter. But this is true of only a small proportion of our lot; the others shade insensibly down to the average of *riparius*; and all these largest ones are accompanied by others of much less stature, taken living side by side, and certainly not specifically different. The difference in the whole series, moreover, is not greater than we demonstrate in the case of unquestionable *A. xanthognathus*.

All the remarks we have offered under head of *A. xanthognathus* have been based upon unquestionable examples of that form. But, after eliminating these, we find a considerable number of specimens that are precisely like ordinary *xanthognathus*, yet have no trace of the chestnut cheeks. They are clearly not referable to ordinary *riparius*, and are equally far removed from the small var. *borealis*.

We puzzled long over these before we were led, we believe correctly, to refer them to *xanthognathus*. Among Mr. Kennicott's extraordinarily full series of *xanthognathus* we found here and there a skin showing no chestnut cheeks, yet which he had labeled with his autograph "*xanthognathus*". This excited our suspicion; for we had noted with pleasure that, of the many hundred mice of all sorts contributed to the collection by this eminent naturalist, not one had been labeled by him of which there was the slightest doubt, and his labeling has proved in every case correct. There is little if any doubt that *xanthognathus*, under certain conditions, does not acquire the chestnut cheeks—in short, that a certain proportion of specimens shade into *riparius*. This goes far to show that the two forms are not specifically distinct. We tabulate below these doubtful skins. It will be seen by the measurements that they represent an animal at and beyond the maximum of ordinary *riparius* in size, with comparatively shorter members; and the skins show a certain undefinable coloration and condition of pelage which assures us they belong nearer *xanthognathus* than *riparius*; but their positive determination is to us at present impossible.

## MURIDÆ—ARVICOLINÆ—ARVICOLA XANTHOGNATHUS? 205

TABLE LI.—Measurements of twenty-nine (and list of many more) specimens of large Arctic ARVICOLÆ of the RIPARIUS type, supposed to represent XANTHOGNATHUS without chestnut cheeks.

Current number.	Locality.	Collector.	From tip of nose to—				Tail to end of—		Length of—		Height of ear.	Remarks.
			Eye.	Ear.	Occiput.	Tail.	Vertebra.	Hairs.	Fore foot.	Hind foot.		
9048	Arctic coast	R. McFarlane										Dry.
9051	do	do										do.
9060	Fort Anderson	do	0.59	1.35	1.40	6.00	1.15	1.60	0.33	0.78		do.
9175	do	do										
9146	do	do	0.56		1.00	5.30	1.00	1.30	0.35	0.71	0.45	Dry.
9155	do	do			1.23	6.00	1.10	1.45	0.34	0.70	0.40	do.
9154	do	do			1.15	5.30	1.30	1.65	0.35	0.70	0.39	do.
9115	do	do				6.00	1.30	1.65	0.34	0.76		do.
9106	do	do	0.50			5.50	1.00	1.40	0.35	0.78	0.40	do.
9144	do	do				7.00	1.00	1.25	0.35	0.76	0.34	do.
9147	do	do				6.75	1.00	1.25				do.
9289	do	do				5.50	1.00	1.45	0.34	0.75	0.44	do.
9335	Anderson River	do				5.75	1.30	1.50	0.37	0.69	0.43	do.
9336	do	do										
9337	do	do										
9193	do	do										
9341	do	do				5.01	1.00	1.00	0.31	0.74	0.43	Dry.
9309	do	do										
9290	do	do										
9378	900 miles south west of Yukon River.	R. Kennicott				5.50	1.35	1.50	0.33	0.73	0.47	Dry.
9396	do	do				5.75	1.30	1.70		0.73		do.
9335	Yukon	do				5.75	1.30	1.55		0.70		do.
9359	do	do										do.
7099	Fort McPherson	C. P. Gandet										do.
7100	do	do										do.
7101	do	do										do.
7102	do	do										do.
9943	Kodiak, Alaska	F. Biscoff										do.
9367	Fort Rae	L. Clarke	0.43	1.00	1.15	3.60	1.00	1.75	0.40	0.90	0.45	6 young.
17728	Red River Settlement	D. Gunn										5 young.
10695	do	do										
10696	do	do	0.50	1.10	1.25	4.50	1.70	2.00	0.39	0.75		
10697	do	do										
10698	do	do										
17655	Saskir Settlement	do										3 young.
10699	do	do										
to	do	do				4.10	1.50	1.80		0.80		
10604	do	do										
7036	do	R. Kennicott										
10695	do	do										
10915	do	do										
7119	Winnipeg River	do										
7790	do	do										
7730	James Bay, Hudson's Bay.	C. Drexler										
7735	do	do										
8394	Big Island, G. S. L.	J. Red	0.44	1.00	1.14	3.90	1.35	1.50	0.38	0.74	0.46	
10917	do	do										
to	do	do										
10904	do	do										

Current number	Locality.	Collector.	From tip of nose to—				Tail to end of—		Length of—		Height of ear.	Remarks.
			Eye.	Ear.	Occiput.	Tail.	Vertebra.	Hairs.	Fore foot.	Hind foot.		
7691	Fort Resolution ...	R. Kennicott ..	.....	.....	.....	.....	.....	.....	.....	.....	.....	
7692	..do ..	..do ..	.....	.....	.....	.....	.....	.....	.....	.....	.....	
7744	Fort Simpson .....	..do ..	.....	.....	.....	.....	.....	.....	.....	.....	.....	
7923	..do ..	..do ..	.....	.....	.....	.....	.....	.....	.....	.....	.....	
to	..do ..	..do ..	.....	.....	.....	.....	.....	.....	.....	.....	.....	
7890	..do ..	..do ..	.....	.....	.....	.....	.....	.....	.....	.....	.....	
7841	..do ..	..do ..	0.47	0.95	1.08	4.00	1.45	1.70	0.40	0.75	0.50	
7570	..do ..	B. R. Ross ..	.....	.....	.....	.....	.....	.....	.....	.....	.....	
9094	Fort Liard .....	R. Kennicott ..	.....	.....	.....	.....	.....	.....	.....	.....	.....	
10977	..do ..	..do ..	.....	.....	.....	.....	.....	.....	.....	.....	.....	
to	..do ..	..do ..	.....	.....	.....	.....	.....	.....	.....	.....	.....	
10930	..do ..	..do ..	.....	.....	.....	.....	.....	.....	.....	.....	.....	
7743	Fort Churchill .....	W. Macdaviash ..	0.50	1.00	1.25	4.40	1.40	1.70	0.39	0.78	.....	nanthog ?
10231	..do ..	..do ..	.....	.....	.....	.....	.....	.....	.....	.....	.....	
10932	Fort Anderson .....	R. McFarlane ..	.....	.....	.....	.....	.....	.....	.....	.....	.....	
10933	..do ..	..do ..	.....	.....	.....	.....	.....	.....	.....	.....	.....	
10234	..do ..	..do ..	.....	.....	.....	.....	.....	.....	.....	.....	.....	
7703	..do ..	..do ..	.....	.....	.....	4.60	1.25	1.55	.....	0.74	.....	
8401	..do ..	..do ..	.....	.....	.....	.....	.....	.....	.....	.....	.....	
8402	..do ..	..do ..	.....	.....	.....	.....	.....	.....	.....	.....	.....	
8403	..do ..	..do ..	.....	.....	.....	.....	.....	.....	.....	.....	.....	
8104	..do ..	..do ..	.....	.....	.....	.....	.....	.....	.....	.....	.....	
8405	..do ..	..do ..	.....	.....	.....	.....	.....	.....	.....	.....	.....	
9010	St. Michael's, N. A.	C. W. Baxter ..	.....	.....	.....	.....	.....	.....	.....	.....	.....	
9461	..do ..	H. M. Baanister ..	.....	.....	.....	3.90	1.25	1.50	.....	0.99	.....	
10735	..do ..	W. H. Dall ..	.....	.....	.....	.....	.....	.....	.....	.....	.....	
10936	..do ..	..do ..	.....	.....	.....	.....	.....	.....	.....	.....	.....	
10937	..do ..	..do ..	.....	.....	.....	.....	.....	.....	.....	.....	.....	
10938	..do ..	..do ..	.....	.....	.....	.....	.....	.....	.....	.....	.....	
10239	..do ..	..do ..	.....	.....	.....	.....	.....	.....	.....	.....	.....	
9907	Nulato, E. A.	..do ..	.....	.....	.....	4.50	1.35	1.55	.....	0.75	.....	
10910	..do ..	..do ..	.....	.....	.....	3.75	1.45	1.60	.....	0.76	.....	
10941	..do ..	..do ..	.....	.....	.....	4.90	1.40	1.50	.....	0.79	.....	
10942	..do ..	..do ..	.....	.....	.....	4.30	1.00	1.80	.....	0.74	.....	
10943	..do ..	..do ..	.....	.....	.....	4.50	1.30	1.50	.....	0.80	.....	
10944	..do ..	..do ..	.....	.....	.....	4.00	1.90	1.35	.....	0.77	.....	
10945	..do ..	..do ..	.....	.....	.....	3.75	1.15	1.40	.....	0.78	.....	
10946	..do ..	..do ..	.....	.....	.....	.....	.....	.....	.....	.....	.....	
10947	..do ..	..do ..	.....	.....	.....	.....	.....	.....	.....	.....	.....	
10948	..do ..	..do ..	.....	.....	.....	.....	.....	.....	.....	.....	.....	
10949	..do ..	..do ..	.....	.....	.....	.....	.....	.....	.....	.....	.....	
10950	..do ..	..do ..	.....	.....	.....	.....	.....	.....	.....	.....	.....	
10951	..do ..	..do ..	.....	.....	.....	.....	.....	.....	.....	.....	.....	
10952	..do ..	..do ..	.....	.....	.....	.....	.....	.....	.....	.....	.....	
10953	..do ..	..do ..	.....	.....	.....	.....	.....	.....	.....	.....	.....	
10954	..do ..	..do ..	.....	.....	.....	.....	.....	.....	.....	.....	.....	
10955	..do ..	..do ..	.....	.....	.....	.....	.....	.....	.....	.....	.....	
10956	..do ..	..do ..	.....	.....	.....	.....	.....	.....	.....	.....	.....	
10954	..do ..	..do ..	.....	.....	.....	.....	.....	.....	.....	.....	.....	

## SUBGENUS CHILOTUS, Baird.

*Arvicola* sp., AUCTORUM.= *Chilotus*, BAIRD, M. N. A. 1867, 516 (type, *A. oregoni* Bach.).—COUES, Proc. Acad. Nat. Sci. Phila. 1874, 190.

CHARS.—Very small. Pelage and proportions of parts as in *Myonomes*, but the ears "small, orbicular, the marginal portion or helix incurved all round, bounding a distinct fossa innominata; the upper and lower roots so close together as to be confluent externally, and thus enclosing the meatus entirely in the anterior rim, however low. Surfaces of the ear almost naked"; plantar tubercles only 5 (†). Dentition combining the anterior lower molar as in *Myonomes*, with the middle and back upper molars as in *Pedomys* or *Pitymys* (other teeth as in *Arvicola* generally, and therefore not diagnostic).

Further details of this section are given under head of its type and only known species.

## ARVICOLA (CHILOTUS) OREGONUS, Bachman.

## Oregon Meadow Mouse.

*Arvicola oregoni*, BACHMAN, Journ. Acad. Nat. Sci. Phila. viii, 1839, 60; Townsend's Narrative, 1839, 315.—

AUD. &amp; BACH., Q. N. A. iii, 1853, 232, pl. clxvii, f. 3.

*Arvicola (Chilotus) oregoni*, BAIRD, M. N. A. 1867, 537.*Arvicola (Chilotus) oregonus*, COUES, Proc. Acad. Nat. Sci. Phila. 1874, 190.

DIAGNOSIS.—*Arvicola minimus* (3–3½-poll.), *palms dimidium plantarum* (½ : ¾); *caudā capite longiore* (1½); *auriculis exiguis, occultis, subnudis, margine plicata*. *Coloribus ferè ut in A. ripario*.

*Least Meadow Mouse, with the colors much as in A. riparius, the ears small, hidden, nearly naked, with folded margin and the meatus rimmed about; 3–3½ inches long, tail 1½, or with the hairs 1½, thus longer than the head, and nearly twice as long as the soles, these twice as long as the palms.*

(No. ††††) At first sight, this little animal looks like a half-grown *riparius*; the next glance, however, shows that it is perfectly adult, and further examination reveals the peculiarities given in the foregoing diagnosis and in the notice of the subgenus. The fur has exactly the texture of that of *riparius*, and the coloration is much the same as in typical examples of the latter—a grizzle of yellowish-brown, rufous-gray, and black, darkest along the middle line of the back; beneath dark plumbeous, strongly hoary; tail indistinctly bicolor, to correspond. In fact, the external characters, both of color and proportions, are so much like those of *riparius*, with one exception,

that they might be described in identical terms. The ears are the notable feature; and they have been so carefully and minutely described by Baird, from the same specimens now lying before us, that, as in case of our diagnosis of *Chilotus*, we may best repeat his words:—

“The ears are low, orbicular, the membrane thickened, the margins or conchal portions much inflected or incurved, like a half open apple-blossom, the concha being inflected all around. The antitragus is well developed, but rather low. The surfaces of the ear appear perfectly naked, with, however, a ciliation of long hairs towards the roots of the concha, on the dorsal surface. A close examination of the auricle in the dried specimen shows a few scattered very short white hairs. The structure of the ear, though in many respects similar to that of *A. pinetorum*, is yet essentially different. Thus the upper and lower roots of the margin of the ear meet anteriorly so as to form even a low rim to the meatus anteriorly completely enclosing the aperture; the edge of the conch is inflected; the region inside the auricle, around the meatus, naked, and the antitragus so much developed as to be capable of completely closing the meatus. In *A. pinetorum* the roots of the upper and lower margins of the ear are widely separated, by a space of a quarter of an inch, the space between these roots and anterior to the meatus being perfectly plane; the edges of the concha or auricle not inflected at all; the inner space around the meatus partly hairy; the antitragus very slightly developed, not valvular nor capable of closing the meatus at all.”

The skull of this species (~~§§§~~) is rather broad for its length ( $0.92 \times 0.51$ ), but has nothing diagnostic about it except the dentition, which curiously unites that of *Myonomes* with that of *Pedomys* or *Pitymys*. Thus, the middle line of enamel on the front lower molar extends so far forward as to separate the anterior on angles each side, and cut these off from the dentine island of the anterior trefoil, so that an additional closed triangle is produced on each side. The middle upper molar develops no snag on its postero-external triangle; and the last upper molar has but one external angle and a long narrow posterior Y.

A miserable specimen from Oregon (No. 3734, U. S. Expl. Exped.) is labeled “*oregona*”, but is not this species at all, being a *Myonomes*. The measurements of the three specimens below given will show to some extent the variations in size and shape. At present, the species is only reported from the Pacific coast of the United States.

TABLE LII.—Measurements of three specimens of *ARVICOLA* (*CHILOTUS*) OREGONUS.

Number.	Sex.	Nature of specimen.	Date.	Locality.	Collector.	Nose to—			Tail to—				
						Eye.	Ear.	Occiput.	Tail.	Vert.	Hairs.	Falms.	Soles.
13393	♂	Dry	Aug., 1855	Shoalwater Bay .....	J. G. Cooper .....	.....	.....	.....	.....	.....	.....	.....	.....
13399	♂	Alc.	—, 1855	Stellacoom .....	G. Buckley .....	0.43	0.75	1.00	3.42	1.90	1.30	0.35	0.61
13331	do	—	—, 1855	Tomas Bay .....	E. Sanuels .....	0.40	0.80	1.05	3.75	1.00	1.15	0.30	0.56
13370	do	—	—	Puget Sound .....	—? .....	.....	.....	.....	.....	.....	.....	.....	.....
13371	do	—	—	do .....	—? .....	.....	.....	.....	.....	.....	.....	.....	.....

NOTE.—Nos. 13370-71, apparently of this species, are too young for positive identification. The teeth are scarcely cut; but, so far as we can judge, the back upper molar will have but one external closed triangle, and a posterior Y-shaped trefoil. The meatus seems to be surrounded by a faint rim, but the upper margin of the ear is not inflected, the concha being perfectly flat.

## SUBGENUS PEDOMYS, Baird.

*Arvicola* sp., AUCTORUM.

= *Pedomys*, BAIRD, M. N. A. 1857, 517 (type, *Arvicola austerus* LeC.).—COUES, Proc. Acad. Nat. Sci. Phila. 1874, 190.

CHARS.—Postero-superior molar with an anterior transverse loop, two interior triangles, one exterior triangle, and a posterior U-, V-, or Y-shaped loop (as in *Pitymys* and *Chilotus*). Medio-superior molar with an anterior, two exterior, and only one interior triangle (lacking the supplementary postero-interior spur or triangle of *Myonomes*). Antero-inferior molar with a posterior transverse loop, two interior closed triangles, one exterior closed triangle, another exterior and another interior open triangle, and an anterior irregular trefoil. Other molars as in *Arvicola* at large. Ears concealed, without inflected margin of conch or rim in front of meatus; antitragus highly valvular, as usual. Tail in the type of the subgenus about equal to the head (about one-third the head and body), in other species not more than one-fourth the trunk, and thus as short as in *Pitymys*. Perfect plantar tubercles only five. No special cranial characters, and external form as in *Myonomes* (except shorter tail), or much as in *Arvicola* at large. Pelage grizzled and rather "austere"; the under parts usually with a peculiar muddy tinge.

Under head of *Arvicola* we have already diagnosticated this section, and after the further remarks just made there is little to say. There are no tangible cranial characters; and, as to the external characters, they are with difficulty describable as any different from those of *Myonomes*; but the tail is shorter, and the animals appear to be even more squat and bunched than *M. riparius*. There are only five perfect plantar tubercles, though the rudiment



of a sixth is often seen. The section may readily be differentiated from its North American congeners by exclusion, thus:—It lacks the peculiar crescent of the last molar of *Myonomys*; it wants the peculiar auricular characters of *Chilotus*; and it has not the enlarged fore claws and glossy pelage of *Pitymys*.

The section was based upon the *Arvicola austerus* of LeConte by Baird, who added to it two other species, *A. haydeni* and *A. cinnamomeus*, neither of which, however, is distinct. *Haydeni* leads into a remarkable form from the plains, very different, in its extreme development, from *austerus*, and still more unlike any other North American species. The discussion of this form is presented in a subsequent article. We insert here the measurements of our skulls of *Pedomys*, and then proceed to consider *P. austerus*.

TABLE LIII.—Measurements of nineteen skulls of PEDOMYS AUSTERUS.

Number.	Locality.	Length.	Height.	Width at—		Length of solar depression.	Length of incisors.	From tip of under incisors to—			Length of solar depression.	Length of incisors.	Proportion of length to width.
				Zygomatic.	Orbits.			Coronoid.	Canthyl.	Descending process.			
22411	Racine, Wis. ....	1.00	0.49	0.60	0.17	0.23	0.30	0.60	0.75	0.80	0.28	0.33	100 : 60
22412	do .....	1.04	0.42	0.68	0.19	0.24	0.30	0.58	0.75	0.77	0.24	0.33	100 : 60
22413	do .....	1.07	0.41	0.68	0.18	0.25	0.31	0.67	0.83	0.87	0.27	0.38	100 : 58
22414	West Northfield, Ill. ....	0.44	0.64	0.17	0.23	0.19	0.65	0.81	0.84	0.24	0.36		
22415	do .....	0.38	0.64	0.17	0.24	0.17		0.75			0.24	0.34	
22416	do .....							0.63	0.78	0.80	0.25	0.33	
22417	do .....	1.05	0.40	0.60	0.17	0.24	0.30	0.62	0.81	0.82	0.25	0.33	
22418	do .....	1.09	0.44	0.63	0.18	0.25	0.25	0.68	0.85	0.89	0.24	0.39	
22419	do .....	1.03	0.41	0.64	0.17	0.23	0.21	0.64	0.78	0.80	0.25	0.35	
22420	do .....	0.97		0.57									
22421	do .....	0.98		0.54									
22422	do .....							0.58					
22423	do .....	1.00			0.16	0.22	0.21	0.60	0.73	0.77			
22424	do .....	1.05	0.40	0.61	0.16	0.23	0.18		0.80		0.27	0.35	
22425	do .....								0.70				
22426	Saint Louis, Mo. ....	1.02	0.40	0.60	0.18	0.21	0.18	0.02	0.74	0.81	0.25	0.33	100 : 59
22427	Calcasieu, La. ....	1.03	0.42		0.18	0.22	0.19	0.02	0.77		0.23	0.30	
22428	Pembina, Dak. ....	1.12	0.40		0.17	0.25	0.20	0.65	0.82	0.83	0.23	0.32	
22429	Fort Pierre, Dak. ....	1.14	0.45	0.65	0.18	0.23	0.19	0.66	0.80	0.87	0.26	0.34	100 : 57
Average	.....	1.06		0.62									100 : 58½

\* 12152-55-61-62: animals not full grown; measurements excluded from the averaging.

† Type of *cinnamomeus*.

‡ Type of *haydeni*.

## ARVICOLA (PEDOMYS) AUSTERUS, LeC.

### Prairie Meadow Mouse.

*Arvicola austerus*, LeConte, Proc. Acad. Nat. Sci. Phila. vi, 1853, 405 (Racine, Wis.; type, No. 2240, Mus. Smith.).—AUD. & BACH., Q. N. A. iii, 1854, 239 (based on LeConte's description).—KAWWICORR, Agric. Rep. U. S. Patent Office for 1856 (1867), 97, pl. xli, upper fig. (Illinois).

*Arvicola (Pedomys) austerus*, BAIRD, M. N. A. 1857, 539, pl. liv (teeth of specimen, No. 4447, from Louisiana, queried as *austerus*), (Wisconsin, Illinois, Missouri, and Louisiana).—COUES, Proc. Acad. Nat. Sci. Phila. 1874, 190.

*Arvicola (Pedomys) cinnamomea*, BAIRD, op. cit. 541, pl. liv (teeth), (type, No. 4447, Mus. Smiths., Pembina, Dak.).

*Arvicola (Pedomys) haydeni*, BAIRD, op. cit. 543 (type, No. 4448, Mus. Smiths., Fort Pierre, Dak.).

DIAGNOSIS.—*A. ripario subsimilis, velere austeriore, forma robustiore, cauda brevior caput æquante aut paulo superante; griseo-murinus, subtus ex albido plumbeus, brunneo dilute lavatus. Long. tot. 4, caudæ 1.25, pedis 0.70.*

HABITAT.—Western States and adjoining Territories, especially Illinois, Missouri, and Michigan. Kansas. Louisiana.

Although this animal is subgenerically different from *Myonomes riparius*, the superficial resemblance is so close that it is difficult to convey in words an intelligible notion of the distinctions. In fact, it looks more like *M. riparius* than like *Pedomys* var. *curtatus*, from which it is not specifically different. The following description is based upon about twenty specimens, mostly from Illinois.

The pelage, though not harsh, is rather coarse, thick, and short, and does not lie smooth enough to possess much gloss; a condition suggesting the apt name "*austerus*". The tail has an average hairiness, with a medium-sized pencil at tip. The ears are about flush with the fur on an average, but in scant-haired specimens may overtop a little. The soles are scant-hirsute for their posterior third, and 5-tuberculate, one of the tubercles of *Myonomes* being wanting. The usual relative proportions of fore and hind feet and of all the fingers and toes obtain. In general form, the animal is stouter and seemingly clumsier than *riparius*; the tail is shorter, averaging little more than the length of the head, but sometimes reaching about one-third the whole length of trunk. The head looks broader than usual, with a very obtuse muzzle and rather short and sparse whiskers.

The upper parts show an intimate "grizzle" of black, brown, yellowish-brown, and grayish-brown, impossible to describe in a single word. This is darkest along the middle line of the back, whence it washes out lighter toward the sides. Some specimens, as No. 2444, are almost pure black along the dorsal area, and the other upper parts are correspondingly dark, showing merely a grizzle with grayish-brown, without any reddish. Others, again, as No. 2454, are as much lighter than the average, having no appreciably darker dorsal area, and the whole upper parts and sides of a light muddy-brown grizzled with brownish-gray.

These colors fade on the sides, without any tangible dividing line, into the peculiar shade of the whole under parts. In an average case, the belly shows a background of plumbeous, strongly washed over with a dirty cinnamon, or muddy rust color. In the darkest-colored individuals, the under parts are deep hoary-plumbeous, with the tips of most of the hairs barely touched with muddy; this peculiar shade, so different from the clear hoary-plumbeous of *riparius*, &c., being a strong mark of the subgenus, and only very exceptionally wanting. In the lightest-colored specimens, on the other hand, the under parts are so strongly invaded by the muddy cinnamon that the plumbeous bases of the hairs are scarcely visible, the dirt-color being continuous, especially along the sides, and so bright as to approach a fawn-color or tawny-brown.

The tail is almost always distinctly bicolor, and it shares the colors of the upper and under parts of the body respectively.

The type of the species (No. 2249, Mus. Smiths.) is a rather unusually dark specimen, especially underneath, being, as Professor Baird has remarked, one of the few in which the cinnamon tips of the hairs are inappreciable. Other specimens, however, received from Major LeConte as typical of his species, have the muddy wash very distinct.

The Louisiana specimen enumerated by Professor Baird (No. ~~1111~~<sup>1112</sup>, Calcasieu Pass, G. Würdemann) is typical *austerus*, and extends the known range of this form. A Kansas example (No. 4218, Neosho Falls, B. F. Goss) is likewise pure *austerus*. Another Kansas specimen (No. 3306, Doniphan County, E. Palmer) leans rather over against var. *curtatus* in the shortness of its tail, though it is typical *austerus* in other respects. A Platte River specimen (No. 3094) is identical with the type of "*haydeni*". The exact state of the case regarding this last is given beyond; here it only remains to examine the other nominal species that has been referred to *austerus*.

The type and only known specimen of "*cinnamomea*" (No. ~~1111~~<sup>1112</sup>, Pembina, Minn.) is, as Professor Baird says, exactly like *austerus* in external characters. The points of difference, if any, lie in the skull and teeth; and we have the data to show that the slight differences observable in these respects are quite within the limits of individual variation. On coming into our hands, the skull lacked zygomata; but the zygomatic width is stated by Professor Baird to have been 0.56, which, with a length of 1.12, gives a proportion of just 100 : 50, which is a little greater length for breadth than

usual. The skull is perhaps "remarkable for its elongation"; but it falls short of the specimen of *haydeni*, which measures 1.14, and only exceeds average *austerus* by 0.06. The supposed difference in the lengths of the nasals and the nasal branches of intermaxillary, owing to the shortness and truncation of the former, is no distinction, as we find it precisely matched in examples of unquestionable *austerus* (No.  $\frac{1117}{1117}$ ; No.  $\frac{1118}{1118}$ ). The alleged differences in dentition are simply a little less deep infolding of the enamel loops on the back upper and front lower molars; so that the lateral triangles of the first-named tooth, instead of being closed up along the middle line of the tooth, intercommunicate; and the same is the case with the anterior exterior triangle of the last-named tooth. But this is merely a slight difference in degree, not of kind. Among our specimens are some as closely approaching this pattern as others recede from it; and the differences in this respect among unquestionable *austerus* are quite as great as between *austerus* and "cinnamomea".

The following table gives the measurements of our series.

TABLE LIV.—Measurements of Fifty-two specimens of ARVICOLA (PEDOMYS) AUSTERUS.

Number.	Sex.	Date.	Locality.	Collector.	Nose to—			Tail to—			Specimen as measured.		
					Eye.	Ear.	Occiput.	End of tail.	End of vert.	Hairs.		Fore foot.	Hind foot.
9093	♂	Spring, 1855	West Northfield, Ill. ....	R. Kennicott....	0.41	0.88	1.10	3.75	1.11	1.31	0.38	Alcoholic.	
9094	♂	do	do	do	0.42	0.88	1.05	3.25	1.04	1.14	0.37	do.	
9091	♀	do	do	do	0.50	0.92	1.26	4.15	1.27	1.53	0.40	do.	
9099	♂	do	do	do	0.48	0.96	1.30	4.00	1.26	1.61	0.38	do.	
9093	♂	do	do	do	0.45	0.93	1.19	3.40	1.21	1.46	0.40	do.	
9094	do	do	do	do					1.30	1.40	0.71	do.	
9093	do	do	do	do					1.25	1.45	0.75	do.	
9096	♀	do	do	do	0.50	0.96	1.26	3.70	1.17	1.40	0.35	do.	
740	do	do	do	do					4.50		0.43	Dry.	
1469	do	do	do	do					3.50	1.15	1.30	0.35	do.
1977	do	Fall, 1856	do	do					3.75		0.38	do.	
1978	♀	Summer, 1856	do	do					3.75	1.20	1.40	0.40	do.
9431	do	Spring, 1855	do	do					3.70	1.10	1.30	0.74	do.
9433	do	do	do	do					4.25	1.45	1.60	0.40	do.
9435	do	do	do	do					3.90	1.30	1.45	0.38	do.
9434	do	do	do	do					4.25	1.25	1.40	0.79	do.
9435	do	do	do	do					3.75	1.10	1.30	0.78	do.
9436	do	do	do	do					4.00	1.45	1.60	0.81	do.
9437	do	do	do	do					3.60	1.20	1.35	0.79	do.
9438	do	do	do	do					4.00	1.10	1.25	0.41	do.
9439	do	do	do	do					4.25	1.25			Fresh.
9440	do	do	do	do					3.50	1.25	1.50	0.38	Dry.
9442	do	do	do	do									Young, dry.
9443	do	do	do	do					3.75		0.30	0.75	Dry.

TABLE LIV.—Measurements of fifty-two specimens of *ARVICOLA* (*PEDOMYS*) *AUSTERUS*—Continued.

Number.	Sex.	Date.	Locality.	Collector.	Nose to—			Tail to—			Specimen as measured.		
					Eye.	Ear.	Occiput.	End of tail.	End of vert.	Hairs.		Fore foot.	Hind foot.
9444		Spring, 1855	West Northfield, Ill. ....	R. Kennicott.				4.35	1.35	1.60	0.38	0.78	Fresh.
9446		do	do	do				3.75	1.10	1.90	0.37	0.74	Dry.
9447		do	do	do				4.00	1.30	1.50	0.40	0.78	Fresh.
9448		do	do	do				4.00	1.10	1.30	0.39	0.69	Dry.
9449		do	do	do				3.60	1.30	1.45	0.40	0.80	do.
9450		do	do	do	0.60	1.00		4.00	1.30	1.55	0.40	0.75	do.
9452		do	do	do				4.25	1.50	1.70	0.38	0.78	do.
9453		do	do	do				3.90	1.35	1.55	0.37	0.78	do.
9454		do	do	do				4.25	1.40	1.60	0.40	0.74	do.
9455		do	do	do				4.35	1.15		0.37	0.76	Fresh.
9456		do	do	do				4.00	1.10	1.30	0.40	0.80	Dry.
9457		do	do	do				3.50	1.15	1.35	0.37	0.73	do.
7598			do	do				4.00	1.40	1.65	0.39	0.78	Alcoholic.
7640			do	do									Alc. young.
9907			do	do				3.90	1.15	1.35	0.40	0.68	Alcoholic.
10064			do	do			0.45	1.00	1.25	1.40	0.40	0.77	do.
10065			do	do			0.50	0.95	1.30	1.40	0.40	0.76	do.
10096			do	do			0.53	1.08	1.40	1.35	0.40	0.70	do.
10097			do	do			0.48	0.90	1.37	1.40	0.40	0.80	do.
10099			do	do			0.40	0.90	1.30	1.40	0.40	0.80	do.
10030			do	do			0.46	0.98	1.18	1.00	0.38	0.78	do.
10031			do	do			0.48	0.98	1.10	1.00	0.39	0.78	do.
10033			do	do			0.45	0.95	1.15	1.30	0.39	0.80	do.
10036			do	do									Alc. young.
10037			do	do									do.
76541	♂		Southern Illinois.	do									3, supposed young.
*10764			do	do									Alcoholic.
to													
10766													
10869			Illinois	J. LeConte				4.00	1.40	1.75	0.38	0.76	Dry.
4715			Wisconsin	do				4.25	1.85	1.90	0.40	0.78	do.
18240			Racine, Wis.	do				4.25	1.35	1.55	0.36	0.75	do.
965			do	P. R. Hoy				3.75			0.37	0.76	do.
296			do	do				4.00	1.30	1.50	0.39	0.75	do.
2997			do	do	0.45				1.17	1.49	0.37	0.73	Alcoholic.
2998			do	A. C. Barry	0.49	0.91	1.19	3.75	1.25	1.44	0.38	0.74	do.
2999			do	do	0.43	0.90	1.17	3.50	1.09	1.05	0.37	0.70	do.
2993			Saint Louis, Mo.	G. Engelmann	0.47	0.85	1.10	3.35	1.00	1.19	0.39	0.73	do.
2998			do	do	0.50	1.05	1.94	4.00	0.90	1.10	0.39	0.70	do.
2999			do	do									Alc. young.
579			do	do				3.75	1.25	1.45	0.40	0.73	Dry.
453			Calcasieu, La.	G. Wüstermann				3.80	1.10	1.25	0.35	0.68	do.
8639		Apr. —, 1867	Burlington, Kans.	A. Crocker					1.10	1.25	0.36	0.65	do.
4916			Neosho Falls, Kans.	B. F. Goss				4.50	1.40	1.60	0.39	0.75	Dry.
8516	♂	Sept. —, 1866	do	do				3.90	1.25	1.35	0.36	0.74	do.
8510	♂	Sept. —, 1866	do	do				3.85	1.15	1.30	0.35	0.73	do.
1591			Pembina, Dak.	C. Cavileer				4.30	1.30	1.50	0.40	0.79	do.
5999			Fort Pierre, Dak.	F. V. Hayden				4.25	1.49	1.55	0.40	0.81	do.
3094	♂	July —, 1857	Platte River	W. S. Wood				4.25	1.25	1.40		0.80	do.
3306			Douglas County, Kans.	E. Palmer					1.10	1.35	0.38	0.75	do.
Average (nearly).....								4.00	1.27				0.71
Maximum .....								4.50	1.40	1.75	0.43	0.81	
Minimum .....								3.50	1.10	1.30	0.35	0.68	

\* Nos. 10764-68 not identified by teeth. † Type of *austerus*. ‡ Type of *cinnamomeus*. § Type of *haydeni*.

## ARVICOLA (PEDOMYS) AUSTERUS CURTATUS, (Cope.)

## Western Prairie Mouse.

*Arvicola curtata*, COPE, Proc. Acad. Nat. Sci. Phila. Jan. 1868, 2 ("Pigeon Springs", east of Owen's Valley, California), (type examined).

*Arvicola pauperrima*, COPE, I, Am. Nat. Dec. 1868, 635 (Great Plains of the Columbia), (type examined).

*Arvicola (Pedomys) austerus* var. *curtatus*, COUES, Proc. Phil. Acad. 1874, 190.

CHARS.—Tail obviously shorter than head. Brownish-gray, beneath much paler, sometimes nearly white. Size of *austerus*, or rather less. Four inches or less; tail vertebræ an inch or less; hind foot  $\frac{3}{4}$  of an inch or less.

HABITAT.—United States, west of the Mississippi. California (*Gabb*, the type; *Feilner*). Great Plains, Washington Territory (*Cooper*). Colorado, Kansas, and Nebraska (*Hayden*, *Goss*), where mixed up with *austerus*.

In handling the present Smithsonian series to pick out our western styles of *A. riparius*, we here and there happened upon a specimen looking quite different from any of the many western strains of *riparius*, and these we put aside together for final determination. They were smallish, with extremely short tail, light gray above and correspondingly pale below, and, though they differed *inter se* to a puzzling degree, we could not believe them referable to any variety of *riparius*. None, unfortunately, were accompanied by separately cleaned skulls; but on wrenching open the mouths of the specimens, as we were obliged to do in every instance, we found, to our surprise, that they were all typical *Pedomys* in dentition, and so entirely different from any breed of *Arvicola riparius*. The westernmost of them were at the same time very different from the blackish muddy-bellied and comparatively long-tailed Illinois *austerus*, yet Kansas specimens were completely intermediate, through the paler style of *austerus* called *haydeni* by Baird. Up to this time we had not thought of *Arvicola curtatus* Cope. That species being compared with "modesta" by its author, and not being indicated as a *Pedomys* at all, we had concluded that it was probably another of the everlasting kinds of *riparius*. Desiring, however, more positive evidence, we wrote to Professor Cope requesting a view of his type, which was promptly sent to us, when we were gratified to perceive, as we did at a glance, that our animal, to which, curiously enough, we had applied in manuscript nearly the same name ("decurtatus") was Cope's species.

Owing to bad taxidermy and neglect to poison the skin, the type of *curtatus* was almost entirely destroyed. As it reached our hands, nothing

was left of it but some comminuted fragments of the skull, some loose teeth, bones of the feet, and a few whiskers. Most fortunately, however, the back upper molar was not lost, and this furnished perfect identification. According to Cope's measurements, his animal was smaller than any others we have seen, but not much so; nor is there, in other respects, any discrepancy sufficient to cast suspicion on the identification we make.

No. 4172.—Very light gray, with a noticeable darker (brownish-black) dorsal area, so much restricted as to appear almost like a dorsal stripe. Below, nearly white, but little soiled, and the pale plumbeous bases of the hairs little apparent; tail short, light brown above, white below; feet above nearly white. (Dimensions as below.)

No. 10268 (Great Plains, Washington Territory; type of *pauperrima* Cooper).—Identical with the last, but the dorsal darkness pretty uniformly distributed. (Dimensions as below.) Tail very short.

No. 3056.—One of the palest *Arvicolas* we ever saw except "breweri". Above, uniform dull pale gray, with scarcely a brown shade and no blackish; below, hoary white, almost as pure as in a *Hesperomys* on the ends of the hairs, but these are so short (the animal was killed in August, probably a young of the year) that their plumbeous bases give the predominant shade; tail and feet hoary whitish; tail extremely short. (Dimensions as below.) The pallor of this specimen is parallel with that of all the other *Murids* of the same region.

No. 3241.—Upper parts an intimate grizzle of gray and brown in equal parts, little if any blackish; below of ordinary *riparius* color; feet and tail brown above; tail short, but its caliber as well as its length undue, because a stout peg has been thrust into its skin after removal of the vertebræ. Rather exceeding any of the foregoing in size (see below). Approximating in color to the next, viz:—

No. 3055.—Rather larger than any of the foregoing, even allowing much for the evident overstuffing; but tail short. In color, almost exactly like the paler "haydeni" stripe of *asterus*; the hoary gray of the belly quite muddy.

With only the type of *curtatus* before us, together with the Californian, Washington, and Utah specimens, we could not have hesitated in admitting the species. But the precisely intermediate Kansas and Nebraska specimens prove that a truer rendering of the facts in the case will be to hold *curtatus* for a geographical differentiation of *asterus*. It will be recollected

that "austerus" is not, in nature, any more "typical" than *curtatus* is; in fact, that the dark, longer-tailed Illinois strain of *Pedomys* is as much an extreme as *curtatus* is. The naming of the animal is a matter of judicious taste. We prefer to relegate the initial step of the westward departure (i. e., "haydeni") to *austerus*, and to designate only the extreme of differentiation as var. *curtatus*. Those of opposite mind, who wish to designate every geographical and climatic modification by a separate binomial, will be obliged, in order to consistence, to do thus: restrict *austerus* to the dark Illinois animal; restrict *curtatus* to the Californian, Washington, and Utah animal; adopt *haydeni* for some Nebraska skins; invent a new name for others, as our pallid No. 3056; and then leave about 75 per cent. of Kansas and Nebraska skins unnamed, or else invent a *fifth one* for these. In this enumeration we neglect "cinnamomeus", as founded on a slight individual peculiarity of the enamel folds, which no one—certainly not Professor Baird—would wish to perpetuate by name, now that the real state of the case appears.

TABLE LV.—Measurements of thirteen specimens of *PEDOMYS AUSTERUS CURTATUS*.

Number.	Locality.	Collector.	Nose to—				Tail to end of—		Fore foot.	Hind foot.	Ear.	Remarks.
			Eye.	Ear.	Occiput.	Tail.	Vert.	Hairs.				
10087	Orean Springs, Cal.	W. M. Gabb.	.....	.....	0.90	2.30	0.40	.....	.....	0.50	.....	Dry, <i>Ad. Cope</i> .
4172	Fort Crook, Cal.	J. Felner	0.48	0.90	1.00	3.75	0.80	1.00	0.33	0.67	0.37	Dry.
10089	Great Plains, W. T.	J. G. Cooper	.....	.....	1.00	3.47	0.75	0.85	.....	0.69	0.37	Fresh ( <i>Cooper</i> ).
3036	Black Hills, Dak.	W. A. Hammond	.....	.....	.....	4.00	0.64	0.90	0.34	0.65	0.40	Dry.
3035	Platte River	do	.....	.....	.....	1(*)	0.90	1.00	.....	0.66	.....	do.
3041	—, Neb.	F. V. Hayden	.....	.....	.....	4.00	0.80	0.90	.....	0.73	.....	do.
4936	Camp Floyd	C. S. McCarthy	0.44	0.83	1.10	3.30	0.65	0.75	0.33	0.65	0.36	Alcoholic.
7364	Carson Valley, Utah	do	0.39	0.70	1.06	3.85	0.60	0.90	0.32	0.65	0.35	do.
7736	Fort Bridger, Utah	C. Drexler	0.40	0.80	1.10	3.50	0.70	.....	0.30	0.60	0.37	do.
10090	do	do	0.46	0.90	1.15	4.00	0.80	1.00	0.34	0.68	0.40	do.
10039	do	do	0.39	0.85	1.05	3.85	0.75	0.90	0.31	0.62	0.34	do.
10040	do	do	0.37	0.74	1.00	3.40	0.60	.....	0.31	0.63	0.35	do.
10041	do	do	0.36	0.81	1.05	3.50	0.70	.....	0.30	0.58	0.38	do.

\* Stretched to nearly five inches; was probably about four.

Among the alcoholics, we find several specimens of *curtatus* from Utah. They are not in very good condition, showing little respecting the pelage (though the colors appear very light, much as in the Fort Crook specimen), but are unquestionably typical representatives of this extreme variety of *austerus*, and enable us to supply some additional particulars, especially as regards dental characters. They range from 3.25 to 4.00 inches in length; the tail-



vertebræ from  $\frac{1}{2}$  to  $\frac{3}{4}$ ; the hind feet,  $\frac{1}{2}$  to  $\frac{3}{4}$ ; the ears are small ( $\frac{1}{2}$  or less), thin, and papery, and appear slightly hairy, but may have lost much of their fur in the alcohol. The soles have but five perfect tubercles, with a minute or rudimentary sixth one.

Several skulls (as Nos. 12033, 12034) which we have extracted from alcoholic specimens furnish occasion for no further comment than that they are strictly of the *Pedomys* type of dentition, and smaller than those of *austerus*, in correspondence with the inferior size of var. *curtatus*; No. 12169 measuring only 0.90 by 0.56, although it is perfectly adult.

#### SUBGENUS PITYMYS, McMurt.

*Arvicola* sp., AUCTORUM.

= *Psammomys*, LECONTE, 1829 (*pinetorum*), (not of Rueppell).

= *Pitymys*, McMURTHIE, 1831 (same type).

= *Pinomys*, LESSON, 1842 (same type).

CHARS.—Below medium size; body cylindrical and otherwise shrew-like in closeness and glossiness of pelage; tail very short—less than the head, little more than the hind foot; ears small, mostly concealed, sparsely pilous, with flat edges, and border of meatus plane in front; feet small, both five-tuberculate; fore-claws not shorter than hind-claws; palms more than half as long as soles; teats only four, inguinal; skull relatively broader than usual; muzzle short, very blunt; nasal branch of intermaxillary reaching beyond ends of nasals; distance from tips of lower incisors to apex of descending process no greater than distance from same point to back of condyle; first under molar with only one external closed triangle and two internal ones; no spur on last triangle of second upper molar; back upper molar with only one exterior triangle and a posterior trefoil.

This section, perhaps the most strongly marked among American *Arvicola*, nevertheless agrees exactly with *Pedomys* in the dentition (the three diagnostic teeth, viz., front under and middle and back upper, being the same), and likewise shares with *Pedomys* the number and position of the mammæ and plantar tubercles. In general cranial and external characters, however, it is quite different; *Pedomys* being in these respects much like *Myonomes*. From *Chilotus*, which has the same characters of the upper molars, it differs in having a less number of lateral triangles on the front under molar, and particularly in the construction of the ear, as detailed elsewhere; besides, in other external characters, *Chilotus* is more like *Myonomes*. The great size of the fore feet and their claws, the small hind feet, and very short tail are strong peculiarities.

Back under molar with three spherical-triangular dentine islands in single series reaching across the tooth. Middle under with posterior spherical triangle; then interior closed triangle; then exterior closed triangle; then two angles generally confluent, but sometimes separated by enamel wall into two (interior first, exterior afterward) lateral closed triangles. Front lower with posterior spherical triangle; then interior closed triangle; then exterior closed triangle; then another internal closed triangle; then the two next lateral angles (one on each side) not separated and closed by a median enamel zigzag, but their dentine areas confluent, and moreover running into the dentine island of the anterior trefoil—this trefoil of variable shape. Thus there are five internal and four external angles in all (counting the lobes of the anterior trefoil). Front upper molar with an anterior spherical triangle, two interior and two exterior lateral closed triangles, the last exterior one being postero-lateral. Second upper molar the same, but with one less interior triangle—an exterior one comes first, then the interior one, then the postero-external one: the latter does not develop the postero-internal snag usually seen in *Myonomes*. Back upper with an anterior spherical triangle; then another like it reaching quite across the tooth, but with its posterior median angle long and acute, and running into the concavity of the posterior U, V, or Y that finishes the tooth. However this last may vary in details, it never approaches the oblique crescent characteristic of *Myonomes*.

We only know one North American species of this section; a second, however, occurs in Mexico.

#### ARVICOLA (PITYMYS) PINETORUM (LeConte).

##### Pine Mouse.

*Arvicola pennsylvanica*, HARLAN, *Fu. Amer.* 1895, 144 (in part; the description,\* but not the synonymy. Not of authors).

*Psammomys pinetorum*, LECONTE, *Ann. Lyc. Nat. Hist. N. Y.* iii, 1872, pl. ii. (Name inept.)

*Pitymys pinetorum*, McMURTRIE, *Am. ed. Univ. R. A.* i, 1931, 434.

*Pitymys pinetorum*, LESSON, *Nouv. Tab. R. A.* 1842, 12.

*Arvicola pinetorum*, AUD. & BACH., *Q. N. A.* ii, 1851, 216, pl. lxxx (excl. syn. "oncia. DeK.").—LECONTE, *Proc. Acad. Nat. Sci. Phila.* vi, 1853, 409.

*Arvicola (Pitymys) pinetorum*, BAIRD, *M. N. A.* 1857, 544.—ALLEN, *Bull. Mus. Comp. Zool.* No. 8 734 (Massachusetts; rare; "probably its northern limit").—ALLEN, *op. cit.*, ii, No. 3, 184 (Florida).—COUES, *Proc. Acad. Nat. Sci. Phila.* 1874, 191.

*Arvicola scalopsoides*, AUD. & BACH., *Journ. Acad. Nat. Sci. Phila.* viii, 1842, 299 (Long Island).—WAGNER, *Wiegmann's Archiv*, 1843, 53.—LECONTE, *Proc. Acad. Nat. Sci. Phila.* vi, 1853, 409.

*Arvicola apella*, LECONTE, *Proc. Acad. Nat. Sci. Phila.* vi, 1853, 405 (Pennsylvania).—AUD. & BACH., *Q. N. A.* iii, 1854, 220. (Same as LeConte's.)

\* "Above a brownish fawn; beneath grayish-white; \* \* length 4 inches; tail  $\frac{1}{2}$  of an inch; \* \* the teats of the female are situated very near the organs of generation; she carries her young between the hind legs."—HARLAN, l. c.

**DIAGNOSIS.**—*Arvicola staturâ inter minimos, (long. trunci 3-4-poll.), formâ quasi-talpoidea sed rostro obtuso, caudâ brevissima (subpollicari), auriculis parvis rotundatis planis subpilis vellere occultis, pedibus exiguis, 5-tuberculatis, manibus latis dimidium pedum excedentibus, unguibus majusculis; vellere curto, denso, sericeo, supra castaneo aut brunneo, subtus canescente-plumbeo.*

Little Meadow Mouse, looking something like a mole, with close silky fur brown above and hoary gray below; tail shorter than the head; small hind feet, with only five tubercles; comparatively large fore feet, more than half as long as the hinder, and with longer claws; and small, flat, round, scant-haired ears concealed in the fur.

**HABITAT.**—United States, chiefly east of the Mississippi, and rather southerly; north to Massachusetts and Missouri. Kansas (*Goss*). Fort Cobb (*Palmer*). Oregon (*U. S. Expl. Exped., Peale*).

Some of the expressions in the foregoing diagnosis rather belong to the subgenus *Pitymys* than to this particular species. The dentition will be found fully elucidated under head of *Pitymys*; here we will continue our account of *P. pinetorum* with a notice of the skull, append a table of measurements, and then recur to external features. Nos.  $\frac{155}{156}$ , ♀, and  $\frac{157}{158}$ , ♂, both from Tarborough, N. C., are more selected for description as being the most perfect, but the other twelve specimens are likewise taken into account.

**Skull.**—It gives an impression of being broader and more massive than that of *riparius*; and figures do bear out the suggestion, although in truth the difference in width or height, as compared with length, is slight; the length relative to the width is as 92 : 57, or as 1.00 : 0.62, on an average, whereas the same proportion in *riparius* is 1.00 : 0.59 only. The absolute size of the skull is as much less as was to have been expected from the animal's smaller stature, and the difference appears to be positively distinctive; for we have never seen an (adult) skull of *riparius* that fell below one inch, and never one of *pinetorum* that touched this figure. Still we suspect that some Massachusetts skulls, for example, might reach it. Our specimens range from 0.90 to 0.97 in length, and the zygomatic width is just about  $\frac{1}{4}$  as much. The average width of *pinetorum* is just at par with the minimum width of *riparius*. There is a noticeable difference in the interorbital width, however; the constriction here being no greater absolutely than that of *riparius*, and consequently being relatively less. The ante-zygomatic or rostral part of the skull is perhaps broader for its length, as well as absolutely shorter. In the

under jaw there is a very nice characteristic of *pinetorum* as compared with any other species we have examined. Owing to the shortness and upward bend of the descending process, or else to some difference in the curve of the whole jaw, the distance from the tips of the incisors to the tip of this process is no greater than the distance from the same point to the back of the condyle; whereas, in the other species, the former measurement is appreciably longer than the latter. The upper molar series measures from  $\frac{1}{4}$  to  $\frac{1}{2}$  of an inch in length; the under a trifle more, usually. The upper incisors project  $\frac{1}{4}$  of an inch, or a little less, from the alveoli; the under ones from  $\frac{1}{4}$  to  $\frac{1}{5}$ . The coronoid process is very slender, falcate, and acute; it rises fairly above the level of the top of the condyle; its apex is generally just about  $\frac{1}{2}$  an inch from the tips of the incisors, and when the jaw is *in situ* is just visible over the upper edge of the zygoma. The greatest depth of the whole skull (closed jaw included) is opposite the anterior part of the orbits, and amounts to nearly  $\frac{3}{4}$  of an inch. The interparietal is (usually) subtruncate laterally; the bony palate has precisely the formation of *Arvicola* proper; the nasal branch of the internaxillary extends a little beyond the end of the nasals, as in *Pedomys*; and we notice nothing peculiar in the individual cranial bones or their sutures or foramina.

TABLE LVL.—Measurements of fourteen skulls of ARVICOLA (FITIMYS) PINETORUM.

No.	Locality.	Length.	Height.	Width at—		Upper molar series.	Upper incisors.	Jaw:—tip of incisors to—			Under molar series.	Under incisors.
				Zygoma.	Orbit.			Coronoid.	Condyle.	Descending process.		
3074	Ohio .....	0.36	0.50	0.18	0.20	0.16	0.50	0.60	0.60	0.20	0.25	
3088	Pennsylvania.....	0.97	0.40	0.62	0.19	0.25	0.19	.....	0.75	0.74	0.24	0.37
3324	Bladensburg, Md. ....	0.38	0.58	0.17	.....	0.20	0.58	0.75	0.75	0.26	0.28	
3325	Clarke County, Va. ....	.....	.....	0.18	0.23	0.18	0.47	0.65	0.65	0.22	0.25	
3326	.....do .....	0.92	0.35	0.55	0.13	0.23	0.17	0.51	0.67	0.67	0.23	0.37
3327	.....do .....	.....	.....	.....	0.24	0.19	0.55	0.70	0.70	0.25	0.28	
3328	.....do .....	.....	.....	.....	.....	0.20	0.58	0.72	0.72	0.25	0.29	
3329	Tarborough, N. C. ....	0.93	0.37	0.58	0.08	0.25	0.20	0.58	0.72	0.72	0.25	0.29
3330	.....do .....	0.95	0.37	0.60	0.18	0.25	0.22	0.50	0.72	0.72	0.28	0.30
3331	Raleigh, N. C. ....	.....	.....	0.19	0.23	0.17	0.50	0.65	0.65	0.24	0.26	
3332	Society Hill, S. C. ....	0.37	0.63	0.20	0.25	0.15	0.52	0.70	0.70	0.25	0.28	
3333	Georgia .....	0.90	0.37	.....	0.19	0.25	0.17	0.50	0.68	0.68	0.27	0.25
3334	.....do .....	0.91	0.34	0.53	0.17	0.23	0.12	0.51	0.63	0.63	0.22	0.26
3335	.....do .....	0.90	0.36	0.55	0.10	0.22	0.17	0.53	0.65	0.65	0.24	0.27
3336	.....do .....	0.90	.....	0.54	0.17	0.23	0.18	0.50	0.65	0.65	0.25	0.29

The subjoined table illustrates fully the size and proportions, and the variation in these respects, of this species. It seldom reaches and very rarely if ever exceeds 4.00 in length of trunk; adults do not apparently fall below 3.00; the great majority range between 3.25 and 3.75, settling at barely over 3.50 on an average. The law of increase of size with increase of latitude is well illustrated, specimens from New England and the Middle States ranging over those from the South Atlantic and Gulf States; the latter perhaps never quite reach 4.00. The short tail, a striking feature, is not so long as the head; its vertebræ run but little over the length of the hind feet, usually, and sometimes are not appreciably longer. The pencil of hairs is about 0.10–0.15 in length; the general hairiness is mediocre. The fore feet are larger comparatively than in any species of other sections of the genus, being broader than the hinder ones, and decidedly more than half as long. Part of this is due to the length of the fore claws, which appreciably exceeds that of the hinder and confers a noticeably "fossorial" character. The palm runs from 0.30 to 0.40 in length, resting at an average of just about three-eighths of an inch. The palms show five callosities; the thumb and its nail is possibly a little larger than ordinary. The hind feet are rather small, ranging from 0.57 to 0.70, and striking just five-eighths of an inch average. The soles are rather scant-haired, and only so to the posterior tubercle; there are only *five* plantar callosities: a posterior internal one, one at base of first, second, and fifth toes respectively, and one at base of third and fourth toes together. It appears from measurements not herewith presented that the ear is only a fourth of an inch (0.20–0.30) high; it is fairly hidden in the fur, is orbicular, and in greatest part flat; the edge is scarcely or not inflected, and the anterior and posterior heels of the rim do not meet in front of the meatus, where, consequently, the surface is plane (not ridged as in *Chilotus*, which compare). The antitragus stands out as an evident flange with a slightly convex free edge; but it is not so large and valvular as in more aquatic species, nor does it seem capable of closing the meatus. There is a great difference in the hairiness of the auricle, perhaps dependent on individual variability, but quite as likely owing to seasonal or other conditions that equally affect the general pelage. In some specimens, the flat part of the conch is nearly as naked interiorly as in *Chilotus*; in others, the same part is well haired; the scooped-out portion is always naked, and the back of the ear always noticeably pilous. The whiskers are shorter than usual,

the longest hardly equaling the head; the obtuse muzzle is entirely furry, except the small emarginate papilla on which the nares open.

The fur of this species is remarkable for its shortness, closeness, and lustre, approaching that of the mole, and in fact betraying the species at first glance. The coloration, too, is singularly uniform; not, indeed, in its shade, but in the evenness with which the shade, whatever this may be, is distributed over all the upper parts, without the slightest variegation. The dense texture and even coloration of the pelage are both due to the same thing: to lack of the longer bristly hairs that in nearly all other species are distributed through the fur of the upper parts.

The precise shade of the upper parts is subject to variation parallel with and as great as that we have demonstrated for *A. riparius*. A part is due probably to individual and seasonal variability, but more is owing, we believe, to climatic influences, since different localities seem productive of local races that appear tolerably constant. In what may be called the typical coloration, prevailing in the Southern Atlantic States, the animal is of a rich glossy chestnut or light bay, which shades into slightly more yellowish-brown on the sides before this glides into the color of the under parts. The latter is a deep plumbeous, strongly silvered over with hoary ash. Some Pennsylvania skins are identical with this; others (among them No. 4714, type of "apella") are much darker, and more truly a dull brown than a bay. The same is the case with some typical "scalopsoides" from southern New England, and generally mountainous as well as northerly specimens are apt to be the darkest. The fine large Illinois series, gathered by the lamented Kennicott, are among the darkest of the whole lot; some of them, in fact, betraying little of the characteristic chestnut. This is the chief basis of the suggested name "kennicottii" in Baird, *op. cit.* 547. One curious specimen, No. 2876, from South Carolina, also mentioned by Baird, *l. c.*, is dark-rufous along the back, with the sides rich fulvous or orange, appearing in marked contrast, as two lateral longitudinal stripes. No. 978, from Ohio, a very young animal, shows something of the same peculiarity, which we have also seen in occasional samples of other species, as in No. 2056 of *riparius*, from Halifax, N. S., and No. 4172, from Fort Crook, Cal. Very young animals normally differ from the adults in being plain mouse-gray, with hardly a trace of bay (No. 744, for example).

The western specimens we tabulate are interesting as greatly extending

the known range of the species, which has not hitherto been reported west of the Mississippi, if we except one or two Missouri specimens, as No. 8130. From Mr. Goss' collection, we judge that the animal is not rare in Kansas. Two of his specimens are the largest we ever saw, exceeding four inches; but they seem to be somewhat overstuffed, as other skins of Mr. Goss' certainly are.\* As evidence of the distensibility of the fresh skin of this and other *Arvicola*, we may instance No. 8139, from Kansas, whose length we do not include in the table, since it surpasses *five* inches as prepared, though, apparently, the animal was under four. Both Mr. Goss' large skins are females; males of his from the same locality are, if anything, a little below the average size. Dr. Palmer's Fort Cobb examples, not noticeable in any other respect, carry the known range of the species still farther westward; while, finally, No. 3732, from Oregon, takes it to the Pacific. This one, secured by the United States Exploring Expedition, probably by Mr. T. R. Peale, has been long in the collection, but seems to have been overlooked, owing to the circumstance that it stands labeled by a curious blunder "*Arvicola occidentalis*", to which it bears a slight resemblance in color alone.

TABLE LVII.—Measurements of sixty-eight specimens of *ARVICOLA (PITYMYS) PINETORUM*.

Number.	Sex.	Nature of specimen.	Date.	Locality.	Collector.	Head to root of tail.	Tail to end of vertebrae.	Palm.	Foot.	Remarks.
10963	♂	Dry.....	Apr. 10, —	Southern States.....	.....	3.90	0.65	0.38	0.63	Measured dry.
9236	.....	Alcoholic	.....	Sag Harbor, L. I. ....	E. N. Byram ..	3.00	0.62	0.40	0.65	Measured in alcohol.
10964	.....	Dry.....	.....	Long Island I. ....	J. LeConte ..	4.00	0.75	0.38	0.63	Type of "scalopoides" LeC.
7787	.....	do.....	.....	Suffolk Co., N. Y. ....	B. A. Merritt ..	3.75	0.71	0.38	0.63	.....
7786	.....	do.....	.....	do.....	.....	.....	.....	.....	0.64	.....
4714	.....	do.....	.....	Pennsylvania.....	J. LeConte ..	4.00	0.62	0.35	0.62	Type "apella" LeC.
7596	.....	Alcoholic	.....	Alleghany Co., Pa. ....	R. L. Wallace ..	3.90	0.95	0.38	0.73	Measured in alcohol.
10965	.....	Dry.....	Nov. —, 1860	Philadelphia, Pa. ....	J. Krider ..	3.90	0.75	0.35	0.64	Measured dry.
3630	.....	do.....	.....	do.....	W. S. Wood ..	.....	0.60	.....	0.58	.....
9546	.....	Alcoholic	.....	Carlisle, Pa. ....	D. Miller, Jr. ..	3.38	0.78	0.38	0.60	Measured in alcohol.
9547	♂	do.....	.....	do.....	.....	3.45	0.70	0.38	0.60	.....
9548	.....	do.....	.....	do.....	.....	3.50	0.78	0.40	0.63	.....
9549	.....	do.....	.....	do.....	.....	3.53	0.75	0.40	0.68	.....
9919	.....	do.....	.....	Bladensburg, Md. ....	R. O. Lowndes ..	3.10	0.60	.....	0.60	.....
1111	.....	Dry.....	Apr. 25, 1856	do.....	.....	3.80	0.78	0.36	0.65	Measured dry.
7363	.....	Alcoholic	.....	Washington, D. C. ....	.....	3.60	0.65	0.40	0.60	Measured in alcohol.
10346	♂	Dry.....	Mar. —, 1853	Clarke County, Va. ....	C. B. R. Kennerly ..	3.60	0.70	0.36	0.58	Measured dry.
10347	.....	do.....	Mar. —, 1855	do.....	.....	.....	0.70	0.30	0.60	.....
10348	♂	do.....	Mar. —, 1853	do.....	.....	3.50	0.70	0.36	0.68	.....

\* His Neesho Falls *Hesperomys*, *Oryzomys*, *Onychomys*, and others, are all larger, as prepared, than usual, though the parts that do not change in drying are of ordinary dimensions.

TABLE LVII.—Measurements of sixty-eight specimens of ARVICOLA (PITYMYS) PINETORUM—Continued.

Number.	Sex.	Nature of specimen.	Date.	Locality.	Collector.	Head to root of ear.	Tail to end of vertebra.	Palm.	Set.	Remarks.
2842	...	Alcoholic.	...	Clarke County, Va.	O. B. R. Kennerly	0.64	0.35	0.63	...	Measured in alcohol.
2843	...	do	...	do	do	0.70	0.40	0.64	...	do.
2844	...	do	...	do	do	0.74	0.40	0.68	...	do.
7431	...	do	...	do	do	...	...	...	...	do.
7432	...	do	...	do	do	...	...	...	...	do.
7613	...	do	...	Clover Green, Va.	A. W. Massey	4.00	0.65	0.68	...	do.
9028	...	do	...	do	do	3.75	0.70	0.60	...	do.
9053	...	do	...	do	do	3.90	0.60	0.62	...	do.
9054	...	do	...	do	do	0.75	0.59	0.63	...	do.
9055	...	do	...	do	do	3.80	0.60	0.63	...	do.
9056	...	do	...	do	do	3.75	0.65	0.65	...	do.
9057	...	do	...	do	do	3.60	0.65	0.62	...	do.
9058	...	do	...	do	do	3.90	0.70	0.65	...	do.
9059	...	do	...	do	do	4.00	0.90	0.68	...	do.
7176	♀	Dry.	...	Tarborough, N. C.	J. L. Bridger	3.00	0.68	0.52	0.00	Measured dry.
7177	♂	do	...	do	do	3.25	0.60	0.35	0.00	do.
4559	♂	Alcoholic.	...	Green Plains, N. C.	G. F. Morse	3.75	0.80	0.90	...	Measured in alcohol.
9061	...	do	...	do	do	3.40	0.90	0.62	...	do.
7178	...	Dry.	...	Raleigh, N. C.	M. A. Curtis	3.00	0.60	0.90	0.65	do.
7179	...	do	...	Society Hill, S. C.	do	3.40	0.65	0.98	0.60	do.
1364	...	do	...	South Carolina?	W. Cooper	...	...	...	...	do.
1365	...	do	...	do	do	3.00	0.60	0.95	0.60	Measured dry.
1366	...	do	...	do	do	3.75	0.75	0.35	0.65	do.
9557	...	Alcoholic.	...	Columbus, Ga.	W. Gesner	3.90	0.80	0.62	...	Measured in alcohol.
9641	♀	do	...	do	do	3.60	0.78	0.62	...	do.
968	...	Dry.	...	Georgia	J. J. Audubon	3.80	0.70	0.38	0.70	Measured dry.
7179	...	do	...	do	do	3.75	0.70	0.36	0.61	do.
946	...	do	...	P. M. E. La.	J. Fairie	3.25	0.60	0.33	0.62	do.
949	...	do	...	do	do	3.25	0.62	0.35	0.65	do.
7619	...	Alcoholic.	...	do	do	3.75	0.75	0.33	0.60	Measured in alcohol.
555	...	Dry.	...	Washington, Miss	B. L. C. Wallis	3.75	0.60	0.39	0.61	Measured dry.
978	...	do	...	Ohio	R. Kennicott	...	...	...	...	Young.
743	♀	do	Spring, 1835	W. Northfield, Ill.	do	2.65	0.65	0.39	0.65	Mother of 744.
744	...	do	do	do	do	...	...	...	...	Nestling of 743.
304	...	Alcoholic.	...	do	do	...	...	...	...	do.
2834	...	do	...	do	do	...	...	...	...	Young.
2835	...	do	...	do	do	2.25	0.70	0.35	0.62	do.
2836	...	do	...	do	do	...	...	...	...	do.
2839	...	do	...	do	do	...	...	...	...	do.
2840	...	do	...	do	do	...	...	...	...	do.
2890	♀	do	...	do	do	...	...	...	...	do.
2921	...	do	...	do	do	...	...	...	...	do.
7844	...	do	...	do	do	3.40	0.60	...	0.70	do.
9960	...	do	...	do	do	2.50	0.65	...	0.65	do.
2970	♂	Dry.	Mar. —, 1835	do	do	2.85	0.75	0.35	0.66	Measured dry.
2970	♂	do	May 9, 1835	Anna, Ill.	do	3.00	0.70	0.34	0.60	do.
2980	♂	do	Apr. 15, 1835	do	do	3.75	0.75	0.35	0.61	do.
4685	...	Alcoholic.	...	Brookville, Ind.	B. Raymond	2.25	0.60	0.37	0.62	Measured in alcohol.
10080	...	Dry.	June 12, —	New Madrid, Mo.	R. Kennicott	2.50	0.80	0.35	0.57	Measured dry.
3130	♂	do	...	Independence, Mo.	J. G. Cooper	2.75	0.80	0.39	0.70	do.
4058	...	Alcoholic.	...	Saint Louis, Mo.	G. Engelmann	4.00	0.90	0.38	0.66	Measured in alcohol.
6136	...	Dry.	—, 1863	Burlington, Kans.	A. Crocker	...	0.75	0.39	0.65	Measured dry.
6281	♀	do	Mar. —, 1890	Necocho Falls, Kans.	B. F. Goss	4.25	0.75	...	0.68	do.
6282	♀	do	Mar. —, 1890	do	do	4.25	0.90	...	0.63	do.
6283	♂	do	Jan. —, 1890	do	do	3.00	0.85	...	0.62	do.



TABLE LVIII.—Measurements of sixty-eight specimens of ARVICOLA (PITYMYS) PINETORUM—Continued.

Number.	Sex.	Nature of specimen.	Date.	Locality.	Collector.	Nose to root of tail.	Tail to end of vertebrae.	Palm.	Sole.	Remarks.
8293	♂	do	Jan. —, 1906	Necocho Falls, Kans.	B. F. Goss	3.95	0.00	0.60	0.60	Measured dry.
9380	♂	do	Mar. 14, —	Fort Cobb	E. Palmer	3.50	0.00	0.65	0.65	do.
9979	♂	do	Apr. 28, —	do	do	3.90	0.56	0.66	0.66	do.
3738	do	do	do	Oregon	U.S. Expl. Exp.	3.00	0.00	0.60	0.60	do.
7568	do	Alcohol	do	Unknown	Unknown	3.25	0.65	0.65	0.65	Measured in alcohol.
9909	do	do	do	do	do	3.25	0.70	0.63	0.63	do.
Average						3.00	0.70	0.63	0.63	

## ARVICOLA (PITYMYS) QUASIATER, Coues.

*Arvicola (Pitymys) pinetorum* var. *quasiater*, COUES, Proc. Acad. Nat. Sci. Phila. 1874, 191.

CHARS.—*Arvicola imaginem A. pinetorum reddens, vellere curto, denso, sericeo, e fusco nigricante, auriculis modicis, sparsè pilosis, rotundatis, vellere longiusculis, antitrago exiguo; manu dimidium pedis, caudâ brevissimâ viz pedibus longiore. Long. trunci 4.33, caudæ 0.70, manus 0.33, pedis 0.66.*

HABITAT.—Mexico. Xalapa (*De Oca*). Tuxpango (*Sumichrast*).

In general form and appearance, this animal somewhat recalls *A. pinetorum*, particularly the larger darker styles of the latter, formerly called "scalopsoides", and we judge that it will be found to fall under *Pitymys*, from the circumstance of its sharing many peculiarities of external form; but this we cannot affirm without an examination of the skull and teeth, which we are unable to make without an unjustifiable mutilation of the two beautifully prepared skins before us. But although it is thus, by its mole-like aspect, allied to *pinetorum*, it is not sufficiently similar to that species to be confounded with it; and it does not bear the slightest resemblance to any other North American species we know of. At first glance, the animal looks quite black; but on closer view this color is seen to be lightened by an auburn shade, owing to a uniform and intimate mixture of dusky-chestnut hairs with the black ones. There are no markings anywhere; the general color changes insensibly on the sides into blackish-ash on the under parts, lightly silvered over with hoary. The tail is like the back above, and indistinctly paler underneath. The fur is very short, fine, and close, and of so rich a silky lustre that, in some lights, it gives an appreciable purplish coppery iridescence. The body is very stout and compact, and all the members are small. The tail is much shorter than the head, and barely longer than the hind foot. The

soles are very sparsely hairy—a central line of nakedness, at least, extending almost to the heel. The plantar callosities are not perfectly plain in the dried skin, but there appear to be only five: one on the inner side of the foot, midway between the heel and tip of the inner toe; one at the base of this toe; one at the base of the second toe; one at the bases of the third and fourth toes; and one at the base of the outer toe; none of them are prominent. The hairs on the dorsum of the feet are scanty, the longest barely reaching the tips of the nails. The fore feet, measured from the extreme palmar tubercle, are just half as long as the hinder and rather broader; the nails seem a trifle longer, and certainly are no shorter than those of the hind. The rudimentary thumb and its obtuse abortive nail are as usual in the genus. The ears are large for this section of the genus, and obviously overtop the fur a little; they are rounded; in the dried state, the anterior margin of the conch is reflected, but this may be an accident of preparation; the rest of the auricle is flat; the antitragus is but slightly developed, being little more than a stiff ridge, incapable of closing the meatus. The flat part of the conch is pretty closely furred both inside and out—the hairs being short and pilous, rising but little beyond the margin of the ear. The tail is very slender as well as short, moderately hairy, and with a slight terminal pencil.

The following measurements are believed to be a very close approximation to the truth, owing to the skillful preparation of the specimens by their distinguished collectors:—

Dimension.	No. 3524.	No. 7006.
Nose to eye .....	0.55	0.45
Nose to ear .....	1.10	1.00
Nose to root of tail .....	4.33	4.45
Tail to end of vertebrae .....	0.70	0.70
Tail to end of hairs .....	0.80	0.80
Height of ear in front .....	0.45	0.45
Height of ear behind .....	0.90	0.20
Length of palm .....	0.33	0.33
Length of sole .....	0.66	0.66
Length of fur on the back .....	0.33	0.33

The type-specimen, No. 3524 (Mus. Smiths.), was taken at Xalapa, Mexico, by M. R. M. De Oca. No. 7006, taken at Tuxpango, Mexico, by Prof. F. Sumichrast, does not differ in any appreciable degree. These are the only Mexican *Arvicole* we have seen.

## GENUS SYNAPTOMYS, Baird.

*Synaptomys*, BAIRD, M. N. A. 1857, 558 (sub *Myode*), and p. xlv.—COUES, Proc. Acad. Nat. Sci. Phila. 1874, 192.

DIAGNOSIS.—Root of inferior incisor ending abruptly opposite last lower molar. Faces of superior incisors longitudinally grooved near outer edges. Construction of molars and general cranial characters as in *Myodes*; palate ending as in typical *Arvicola*. External characters as in *Arvicola*; ears equaling or overtopping the fur; tail equal to or longer than hind foot. Pelage very soft and full.

The preceding paragraph gives the essential characters of the most remarkable genus of the subfamily—one singularly combining the peculiarities of two other widely separated Arvicoline genera. It may be defined in a word as the skull and teeth of *Myodes* in the body of *Arvicola*, with the additional *sui generis* feature of grooved upper incisors.

This genus was happily characterized in 1857 by Professor Baird, but upon such imperfect and unsatisfactory material\* that he did not formally introduce either the genus or the species in the body of his work, though he gives *Synaptomys* as a subgenus of *Myodes* and catalogues *S. cooperi* in his introductory list (p. xlv). Doubtless in consequence of these circumstances attending its first publication, the remarkable form, although defined, as far as the materials went, with precision, has scarcely been recognized by other naturalists. We are able to confirm the validity of the genus and add all the details hitherto deficient.

Since 1860, the skin of some small *Arvicola* collected in August, in Skaget Valley, by Dr. C. B. R. Kennerly, has lain unnoticed in the Museum of the Smithsonian on account of its inaccessible condition, having been skinned through a small abdominal aperture, the skin left turned wrong side out and stretched on a hooped twig, Indian-fashion; nothing thus appeared from the outside, even the tail and hind feet being tucked in out of sight. A crushed skull, uncleaned, fortunately hung by the lips. In this condition, the specimen was entered in the Smithsonian archives, some twelve years since, as "*Arvicola oregona*", a presumptive identification having been ventured upon the strength of the locality and apparent small size of the object. During

\* No. 1335, Mus. Smiths., merely a rat-eaten bunch of fur, lacking head, tail, and three of the feet, but with one of the fore feet attached, and accompanied by a defective skull; and No. 1366, a skin with the feet and tail, but wanting head and skull. Locality unknown, but supposed to be one of the Northern United States. Received from Mr. William Cooper.

the present investigation, while we were engaged upon *Chilotus*, and somewhat short of material, we turned to this presumed *Arvicola oregonus*, moistened the skin, and carefully reversed it, when we found it was not *Chilotus* at all, but apparently an undescribed species of *Evotomys*. On cleaning the skull, of which we succeeded in securing, among other fragments, the lower jaw entire, the palate with the molars intact, half of one zygomatic arch *in situ*, and the rostral portion with the incisors, we saw, to our surprise, that the cranial and dental characters were not in the least like those of *Evotomys*, but nearly identical with those of *Myodes*. It then only required a reference to Baird's work for the recognition of *Synaptomys*. Shortly after this discovery, a series of seven perfectly prepared skins was sent us from Neosho Falls, Kana., accompanied by several nicely cleaned skulls. We are, therefore, able to define the form to our entire satisfaction. There is no genus of American *Muridæ* more strongly marked than the present, as the following detailed descriptions will show.

The most conspicuous and diagnostic, if not really the most important, character is the sulcation of the upper incisors. This is a unique feature among American *Arvicolinæ*, if not in the subfamily; and, in the American representatives of the whole family *Muridæ*, only recurs in *Ochetodon* of North, and *Reithrodon* of South, America. The groove runs near the outer edge of the face of the tooth (in *Ochetodon* and *Reithrodon* it is median). The incisors are short, broad for their length, and much curved; the general face is rabbeted down externally, so that when viewed in lateral profile the portions on either side of the groove appear parallel and one in front of the other. The incisors approach a character more fully developed in *Myodes*, of being essentially enamel tubes not completely filled up with dentine, thus calling to mind the condition of an unfinished quill-pen after the first oblique slice has been shaven off, and before the nib is finished. Their tips, instead of being straight and transverse, are generally nicked at the end of the groove.

The inferior incisors are equally remarkable, not only in their own characters, but in the resulting modification of the under jaw. Exactly as in *Myodes*, their roots stop abruptly just in front, and a little to the inner side, of the root of the last lower molar. In all the other genera of *Arvicolinæ* we have examined, except *Myodes* and *Cuniculus*, the root of the under incisor runs past (outside) the root of the last under molar, and up the ramus of the jaw behind, to a varying distance, toward the condyle itself. This passage of

the incisor-root up the ramus results in, and is betrayed by, a prominent superficial ridge or thickening that runs from the inside of the back of the condylar ramus downward, forward, and a little inward, to connect with the posterior extremity of the alveolar ridge. In *Myodes*, *Cuniculus*, and *Synaptomys*, this ridge is wanting; the whole condylar ramus being thin and flat, its inner face nearly plane, and separated from the posterior end of the alveolus by a strong sulcus. Moreover, the passage of the incisor-root so closely along the under border of the body of the jaw confers upon the latter a massiveness not seen in other genera. The protruding ends of the incisors offer nothing peculiar.

There is not much else to note in the lower jaw. The apex of the coronoid reaches nearly or quite to the level of the condyle, as in *Arvicola* generally. The descending hamular process, as in *Myodes*, is large, strong, curves strongly outward, and has a much inflected lower border, so that its inferior aspect is a flat surface instead of a border; and the notch between it and the back of the condylar ramus is wide and deep. The muscular impressions upon the side of the jaw are deep and strong, bounded by prominent sharp ridges.

As is well known, the molar teeth of *Myodes* (as restricted to exclude *Cuniculus*) are both individually and collectively distinguishable on sight from those of other *Arvicolinæ*; for, although constructed essentially upon the same plan of aggregated rootless prisms, their details are quite different. In ordinary *Arvicolinæ*, the molars as a series are sharply serrate, both internally and externally, by reason of the acute salient and reëntrant angles they present from first to last, both above and below. Now in *Myodes*, of the upper molars the outer saliciencies are similarly sharp, but the outer reëntrances are so deep that they reach almost across the teeth to the inner side; while the inner saliciencies are so obtuse and the inner reëntrances so shallow that the inner border of the series as a whole is *crenate* instead of serrate; and in *Myodes*, again, of the under molars, the inner saliciencies are sharp and the inner reëntrances deep, while the outer saliciencies are so obtuse and the outer reëntrances so shallow that the outer border of the series as a whole is crenate instead of serrate. Thus, in *Myodes*, one border of both upper and under molar series is crenate, the other serrate, the crenation being external in the under molars, and internal in the upper molars. Now this molar pattern is repeated in *Synaptomys* with such fidelity that we can indicate no difference of generic import; and thus the great difference between the molars of *Synaptomys*, and of *Arvicola* with its subdivisions, as well as of *Erotomys*, becomes evident.

In *Synaptomys*, the front upper molar is composed of five prisms, and its crown of as many closed dentine islands surrounded by enamel walls:—an anterior loop across the tooth, then a small internal triangle close to the first, then a larger external triangle widely separated from the first by a reëtrance reaching the inner side, then a small internal triangle close to the last, then a postero-external loop, the latter separated from the last by a very deep reëtrance similar to the other reëtrance. The middle upper molar has four dentine islands:—an anterior loop reaching across the tooth, then a large external triangle that also extends across the tooth, then a small strictly internal triangle, and then a directly posterior loop. The last upper molar has likewise four dentine islands, all of which are rather transverse loops than triangles, and really reach from side to side of the tooth; the first of them is separated from the next, and this second from the third, by a deep external reëtrance, while the fourth is separated from the third by a similar internal reëtrance. All this of the upper molars is exactly as in *Myodes*.

The front under molar, like the front upper one, has five dentine islands:—an anterior loop somewhat trefoil-shape or triangular reaching across the tooth, then a large internal lateral triangle, then a very small external lateral triangle, then a large triangle reaching nearly across the tooth, and finally a posterior loop reaching quite across. But the external lateral is so minute and inconsiderable, and the two internal saliencies between the anterior and posterior ends of the tooth make such large triangles, that the tooth might be thus described: an irregular anterior trefoil, a regular posterior crescent, with two large triangles between, one or both of which may bear a small spur, isolated or not, upon its exterior angle. The middle under molar has four triangles, of which the first one and last two are large and go quite across the tooth; the other one is a minute external appendage to the first one, hardly distinguishable. In this tooth only is there a slight difference from *Myodes*, which has an additional triangle anteriorly, making five in all. The back lower molar is almost exactly like the middle one, having the same four triangles; it is merely a little smaller, but the minute external triangle may not be obvious, leaving apparently three. Both the middle and lower one may be described as being in general shape like the letter M, with the two legs and middle saliency of the M internal and acute, and the two horns of the M obtuse and external.

The molar series, as wholes, are of about ordinary length, measuring 0.26 to 0.30 in length; their length, relative to the skull, is as 0.28 to 1.12, or.

25 to 100—one-fourth. The series of opposite sides are strongly convergent anteriorly, so that they would about meet if produced little beyond the incisors. This is nearly as in *Myodes*, where, however, the convergence is rather greater. Singularly enough, the formation of the palate behind does not agree with either *Myodes* or *Evotomys*, but is nearly as in *Arvicola* proper—*amphibius* or *riparius*, for instance. The post-palatal notch is a deep emargination on the median line posteriorly carried to opposite the space between the last and penultimate molars, and on either side of this emargination lies a conspicuous deep ovate fossa; there is the same step down to the level of the margins of these fossæ that is seen in *Arvicola* proper, but the fossæ are larger and deeper. (In *Myodes*, these fossæ really do occur, and of great size; but they are so much hidden, by being tucked under the apparent termination of the palate, that the palate seems to have essentially the same construction as in *Evotomys*; i. e., to end as a broad shelf, nearly transverse.)

In general configuration, the skull is near that of *Myodes*. The zygomatic width equals or just exceeds half the total length. The interorbital constriction is very great, the skull being here narrower or at most no broader than the rostral part. The cranium protrudes far into the orbital cavities, with a prominent angular outline. The incisive foramina are short and narrow, opening considerably behind the incisors, and closing again as much in front of the molars. The nasal bones and nasal branches of the premaxillaries are of about equal length, neither reaching the interorbital constriction. The zygomatic arches are widespread, and have the peculiar perpendicular expansion of the jugal bone and of the malar spur of the maxillary, forming quite a broad oblique plate, as in *Myodes*. The difference is very noticeable on comparison with the much slenderer and more terete zygomata of other *Arvicoline*. The anteorbital foramina open entirely underneath the anterior roots of the zygoma, so that the latter scarcely show from above the slight nick usually evident in other genera; the foramina themselves have the ordinary pyriform shape.

The rostral part of the skull is remarkably short, thick, and blunt. Its length, from anterior root of zygomata to tip of nasal bones, scarcely exceeds its width, and is less than its depth. The nasal bones are short, broad, and obtuse, ending behind a perpendicular line let fall against the faces of the incisors. The sphenoidal alæ are broad and short, flaring away from the rather small and short pterygoids. The basioccipital and basisphenoid are narrow, so that the tympanic bullæ, which are large, lie with slight mutual

obliquity. The foramen magnum is subcircular, with somewhat of an emargination superiorly; the paroccipitals are elongated processes. In general shape, the skull may be called, in comparison with other skulls (except of *Myodes*), short, shallow, broad, with flattened coronal and convex frontal profile. (In ordinary *Arvicola*, the parietal region is highest, thence sloping gradually to the muzzle.)

TABLE LVIII.—Measurements of five skulls of *SYNAPTOMYS COOPERI*.

Dimension.	No. 1429 (type).	No. 3798 (Oregon).	No. 6915 (Kansas).	No. 6916 (Kansas).	No. 1454 (Indiana).
Total length (occipital protuberance to end of nasals) .....			1.14	1.07	1.04
Greatest zygomatic width .....			0.73	0.68	0.64
Least width (at interorbital constriction) .....	0.14		0.15	0.13	0.12
Width of rostrum .....			0.25	0.30	0.17
Intermastoid width .....			0.58	0.55	0.53
Interparoccipital width .....			0.37	0.37	0.37
Height of skull (opposite and including last molar) .....	0.36		0.45	0.44	0.40
Length of upper molar series .....	0.26	0.27	0.30	0.28	0.25
Length of extra-alveolar portion of upper incisors .....	0.17		0.24	0.20	0.20
Length of rostrum .....	0.27		0.25	0.22	0.27
From tip of under incisors to apex of coronoid .....			0.62	0.60	0.57
From tip of under incisors to back of condyle .....	0.70	0.75	0.70	0.77	0.70
From tip of under incisors to end of descending process .....	0.76	0.76	0.81	0.81	0.78
Length of under molar series .....	0.25	0.23	0.28	0.28	0.25
Extra-alveolar portion of under incisors .....	0.22	0.22	0.25	0.27	0.25

As has been intimated, *Synaptomys* is the skull and teeth of *Myodes* in the skin of an *Arvicola*, the resemblance to the latter in external features being strikingly complete, while the differences from *Myodes* are equally obvious. While the ears of *Myodes* are minute, never reaching the level of the general fur, in *Synaptomys* the ears (now for the first time seen) are rather longer than they will average throughout *Arvicola*, in fact almost equalling those of *Evotomys*. In the Kansas skins, they come to the surface of the fur, though these animals are in heavy pelage; and, in the Oregon skin, a summer animal in poor pelage, they distinctly overtop the fur. They have nearly the same shape as in *Evotomys*; the anterior and posterior roots of the auricle come close together in front, but do not form a little rim as described under *Chilotus*; they are scant pilous behind, but rather more hairy internally on the flat portion, though the inner inflated portion is nearly naked. The antitragus has only very moderate development. The fore feet show none of the fossorial nature of those of *Myodes* or *Cyniculus*; the claws do



not noticeably if at all exceed those of the hind feet, and are of ordinary arvicoline shape. The fingers have the usual relative lengths;\* thumb rudimentary, with abortive, flat, appressed nail; third digit longest, fourth scarcely shorter, second shorter, fifth much the shortest. The fore feet are between  $\frac{2}{3}$  and  $\frac{3}{4}$  as long as the hinder, as usual; on top, furred moderately, the longer terminal hairs reaching the ends of the claws but not concealing them; under the fingers, naked and annulate; on the palm, naked, with the following tuberculation: besides the pollical node, there is a tubercle just antero-external of this, another at base of the fifth and second toes respectively, and another at conjoined bases of third and fourth toes—five in all, counting the pollical protuberance. The hind feet, likewise, show nothing noticeably different from *Arvicola* or *Evotomys*; speaking in general terms, the relative size is the same, and so are the proportionate lengths of the digits. The feet are hairy on top to the claws (the longest terminal hairs just reaching the ends of the claws), and the soles are moderately furry on the posterior third (as far as the back tubercle); perhaps a trifle pilose for ordinary *Arvicola*, but showing nothing of the dense furriness, like a rabbit's, of *Myodes* or *Cuniculus*. There are six plantar tubercles, as usual in *Arvicoline*, thus disposed:—one posterior, of moderate size, conical, not lengthened, situate about half-way between heel and bases of middle toes; a smaller one close by, but a little further forward and more external; then one at base of inner toe—these three completing a triangle; one at base of second toe; one at base of fifth toe; one between bases of third and fourth toes. The toes, as usual, are strongly annulate beneath, with terminal smooth pad. The tail has nearly the usual length, calibre, and hairiness of *Arvicola*, showing no approach to the brevity and rabbit-like furring of *Myodes* or *Cuniculus*. Its length varies in our specimens. In Baird's type, No. 1368, the only tail seen till now, this member is noticeably longer than the hind foot, and distinctly bicolor; in our Oregon animal, No. 3798, it barely exceeds the hind foot, and is indistinctly bicolor; in the Kansas skins, it averages no longer than the hind foot, and is almost unicolor.

In color, both as to its pattern and its shade, and in general superficial appearance, there is little to distinguish this animal from *Arvicola riparius*, for instance. Aside from the Oregon animal, which is in poor if not sickly condition, and taken in August, the pelage is beautifully fine, soft, and full,

\* The right fore foot of No. 8508 shows a curious abnormality; the third digit being arrested in development, so that it is no longer than the fifth. The left fore foot is normal.

and very long. The whiskers are numerous, of moderate length, exceedingly fine, almost invisible without a good light. The fur on the back is half or three-quarters of an inch long; that of the tail and all the feet is very fine and rather scant, so that in alcoholic specimens these members show quite light-colored. The tail has a very scanty terminal pencil; the muffle is entirely hairy, except the little nasal pads, and extremely obtuse; the head short, thick; the eyes are very minute, situate about half-way from nose to ear; the whole form is stout and compact.

In the mouth of this animal may be observed, in addition to the tufts of hair that turn inward and nearly meet behind the upper incisors, a tuft growing inside the edge of the lip, and another hairy patch extending backward from the angle of the mouth.

This is undoubtedly one of the most perfect connecting links yet discovered between different genera of *Arvicolinae*, if not of the whole family *Muridae*. The habitat, too, of this false lemming is highly interesting, being quite out of the range of *Myodes*. Baird's types came from some unknown place, believed however to be somewhere in the United States, and now the animal turns up from Indiana, Illinois, Minnesota, Kansas, Oregon, and Alaska. The Kansas locality, Neosho Falls, where Mr. Goss has collected with such valuable results, seems peculiar in its fauna. There occur such southern types as *Oryzomys*, *Sigmodon*, and *Ochetodon*, in connection with the peculiar *Onychomys* and with the *Synaptomys*—which latter ought, according to its zoological characters, to be a highly boreal animal.

#### SYNAPTOMYS COOPERI, Baird.

*Myodes (Synaptomys) cooperi*, BAIRD, Cat. in M. N. A. 1857, p. xlv.

*Synaptomys cooperi*, BAIRD, M. N. A. 1857, 558, in text (United States!).—COUES, Proc. Acad. Nat. Sci. Phila. 1874, 194.

*Arvicola (Synaptomys) gosii*, BAIRD, MSS. (on labels of the Kansas specimens, in anticipation of their proving different from the original *cooperi*).

DIAGNOSIS.—*S. facie Arvicolæ riparii, sed caudâ breviorē, artubus exilioribus, rostro obtusiorē, vellere ampliorē; murino-brunneus, plus minusve griseus, subtus ex albidō griseo-plumbeus. Long. tot. 4, caudæ subpoll., pedis  $\frac{3}{4}$ , auriculæ  $\frac{1}{2}$ .*

HABITAT.—Indiana, Illinois, Kansas, Minnesota, Oregon, and Alaska.

Our notice of the genus has proved so fully illustrative of its single species that there is little to add. The original specimens of *cooperi*, as far

as the fragments show, are a little lighter brown than most of Mr. Goss' late winter and early spring skins, especially No. 1368, which has also the tail more distinctly bicolor than it is in these. But some of the Kansas ones are identical in color with the types; and they vary as much among themselves in color as some of them do from Nos. 1367-8. The tails of all, except No. 1368, are not evidently bicolor. The under parts are hoary-ash, usually soiled, especially across the abdomen, with pale muddy-brown, somewhat as in *A. austerus*, but not approaching the cinnamon shade that the latter frequently exhibits. The tail and feet in dried skins are dark fuscous; in alcoholic species light brown, with a flesh-colored shade. The incisors are yellow, as usual; the claws brownish-white. Besides the copious long fine pelage of this animal, there seems to be something peculiar in the tenderness of the skin itself; the feet are detached almost at a touch, so that the labels cannot be secured in the ordinary way. The following table shows to some extent the range of variation in size:—

TABLE LIX.—Measurements of eighteen specimens of *SYNAPTOMYS COOPERI*.

Number.	Sex.	Date.	Locality.	Collector.	Nose to—				Tail to end of—				Remarks.
					Eye.	Ear.	Occiput.	Tail.	Vert.	Hairs.	Fore feet.	Hind feet.	
1367	♂	.....	Unknown (U. S. I.)	W. Cooper.....	.....	.....	.....	.....	.....	0.37	.....	.....	Type of cooperi.
1368	♂	.....	do	do	.....	.....	.....	.....	.....	0.80	0.90	0.35	do.
3798	♂	Aug. 5, 1889	Skagit Valley, Oreg.	C. B. E. Kennerly	.....	3.56	0.75	0.88	0.34	0.70	0.48	.....	Measured dry.
8464	♂	Winter, 65-6	Neosho Falls, Kans.	B. F. Goss.....	0.50	0.90	1.10	3.60	0.60	0.70	0.36	0.67	do.
8508	♂	Mar. —, 1890	do	do	0.60	1.10	1.25	4.11	0.75	0.90	0.40	0.78	do.*
8509	♂	Feb. —, 1890	do	do	0.57	1.07	1.30	3.75	0.80	1.00	0.45	0.76	do.
8510	♀	Mar. —, 1890	do	do	0.52	0.95	1.25	4.30	0.80	0.95	0.38	0.78	do.
8511	♀	Feb. —, 1890	do	do	0.53	1.05	1.30	4.12	0.85	1.00	0.40	0.77	do.
8512	♀	Feb. —, 1890	do	do	0.50	0.98	1.18	3.75	0.85	1.00	0.41	0.75	do.
8513	♀	Mar. —, 1890	do	do	0.56	1.00	1.22	3.60	0.95	1.00	0.39	0.76	do.
8514	♂	Spring, 1890	do	do	0.52	0.98	1.25	4.00	0.65	0.80	0.45	0.75	Measured alcoholic
8515	♂	do	do	do	0.50	1.00	1.30	3.75	0.84	0.78	0.46	0.76	do.
8516	♂	do	do	do	0.47	0.90	1.10	3.80	0.55	0.65	0.40	0.69	do.
8517	♂	do	do	do	0.45	0.85	1.10	3.90	0.51	0.60	0.38	0.67	do.
9963†	♀	do	Brookville, Ind.	R. Haymond	0.46	0.90	1.10	3.85	0.58	0.80	0.40	0.70	do.
10375	♂	do	Benton Co., Minn.	O. E. Garrison	0.44	0.90	1.10	3.30	0.60	0.75	0.33	0.69	do.
7044	♂	do	Southern Illinois.	B. Kennicott	0.40	0.90	1.10	3.50	0.60	0.70	0.35	0.70	do.
10937	♂	Feb. —, 1897	Nulato, Alaska.	W. H. Dall	0.41	0.89	1.09	3.50	0.75	1.00	0.40	0.78	do.

\* But the length of head and body and of tail are as taken in the flesh by Mr. Goss for Nos. 8508-13. He seems to have taken the tail-measurement further up the coccygeal vertebrae than is generally done, so that the tails as given equal that of No. 1368, whereas they are certainly shorter. Our measurements of the dried tail, did we make any, would run fully 0.10, if not 0.90, less than Mr. Goss' figures. Our measurements of the alcoholic specimens are the most reliable of the series. Nos. 8516, 8517, are not full grown.

† In No. 9963, apparently a nursing female, we find two pairs of pectoral mammae and one pair of inguinal mammae, without being able to make out any intervening ventral ones. It is probable, however, that the species possesses a ventral pair, making eight teats in all.

## GENUS MYODES, Pallas.

*Mus* sp., LINNÆUS, and other earliest writers.

*Arvicola* sp., of different writers.

< *Hypudaeus*, ILLIGER, 1811, in part; includes *Mus lemmus*, *amphibius*, &c.; not of late writers.

< *Lemmus*, LINCK (*vide* Baird), in part; includes the *Arvicola*.

< *Georychus*, RICHARDSON, F. B.-A. I, 1829; and AUD. & BACH., Q. N. A. III, 1854, in part; includes *Cuniculus*; not of Illiger, which belongs to an entirely different family.

< *Myodes*, PALLAS, Zoog. R.-A. I, 1831, 172, in part; includes *Arvicola*, and thus about equal to his "*Mures cunicularii*" of 1778.

= *Myodes*, COUES, Proc. Acad. Nat. Sci. Phila. 1874, 194.

**CRANIAL CHARS.**—Skull massive, low, broad (*zygomatic width upward of two-thirds the length*); cranial portion encroaching upon the orbital cavities with a strong salience; rostral portion obtuse, broad, short (about one-fourth the entire length), not narrower than the interorbital constriction; nasals and intermaxillaries subequal in length, falling short of the orbits; anteorbital foramen small, nearly underneath the anterior root of the zygoma; malar branch of maxillary, and jugal itself, expanded into a broad lamina; bullæ osseæ moderate, their inner borders approximated and nearly parallel through narrowness of basioccipital; incisive foramina short and narrow, not reaching to opposite anterior molars; palate ending behind as an emarginated shelf (with or without a median azygos projection) opposite the interspace between the penultimate and last molars, and the space between these teeth of opposite sides thus broadly open, but the lateral fossæ that occur in most *Arvicoline* still evident, though pushed forward under the edge of the palatal shelf; pterygoid processes widely divergent and very low; under edge of lower jaw very broad from passage along it of root of incisor; ramus of lower jaw thin and plane, from lack of incisor-root extending up it; descending process strong, flattened underneath, and much twisted; apex of coronoid as high as condyle.

**DENTAL CHARS.**—Molar series long (more than one-fourth the length of the skull), strongly convergent anteriorly, and the individual teeth large. Molars strictly of the prismatic type characterizing *Arvicoline*, but in the details of their crowns different from those of any genus except *Synaptomys*, with which they correspond almost precisely; first upper and under molars longest, the others successively diminishing a little in length, but all of nearly the same width throughout, though the under molar may narrow a little from before backward; of the upper series, the external reëntrances very deep, reaching almost across the teeth, the external saliences very acute; of the under series, the internal reëntrances very deep, reaching almost across the

teeth, the internal saliciencies very acute; of the upper series, the internal saliciencies obtuse and the internal reëntrances shallow; of the lower series, the external saliciencies obtuse and the external reëntrances shallow; first upper molar of 5 triangles, 1 anterior, 2 interno-lateral, and 2 externo-lateral, these alternating, the first lateral one being internal; middle upper molar of 4 triangles, the first 2 transverse, 3d interno-lateral, 4th externo-lateral; back upper molar of 4 triangles, or rather crescents, all transverse; front lower molar with 5 triangles; an anterior irregular trefoil, a lateral posterior loop, 1 external and 2 internal lateral triangles; middle lower molar like front lower molar, but an interno-anterior triangle replacing the trefoil; back lower molar with 4 triangles, the 2 posterior entirely transverse and approximated at their outer ends, the other 2 lateral, alternating, the 1st being antero-internal. (Thus, the front molars, both upper and lower, are 5-prismatic, with as many inclosed dentine islands on their crowns; the back molars, both upper and lower, are 4-prismatic, with as many inclosed dentine islands on their crowns; the middle upper like both back ones, 4-prismatic; the middle lower, like both front ones, 5-prismatic; and this 5-prismatic middle lower molar is the only diagnostic one as compared with *Synaptomys*, in which the same tooth has only four prisms.) Upper incisors ungrooved, but much beveled off laterally, and appearing like tubes of enamel through deficiency of dentine behind, where they begin to come to an edge; about as wide as deep, and much curved. Under incisors remarkable in that their roots do not reach beside and behind the last molar up the condylar ramus, but stop abruptly in front of the last molar.

EXTERNAL CHARS.—Size of the larger *Arvicola*; form very stout and compact; colors usually variegated and often changing with season, as in many other Arctic mammals; pelage very long and thick, cold-proof; snout blunt, hairy except the nasal papillæ; external ears, though well formed, small, at most never coming to the surface of the fur; fore feet large, with the claws about equaling the hinder without the claws; thumb obsolete, with a large ligulate claw; all the other claws very long and fossorial, exceeding the hinder, but lacking the peculiar development seen in *Cuniculus*; 3d claw longest, 4th but little shorter, tip of 2d reaching base of 3d, 4th much shorter; palms sometimes naked, sometimes furry to the claws; when naked, thin, tuberculate. Hind feet short, only exceeding the fore by the length of their claws; claws moderate; 3 middle toes longest and about equaling

each other, the 1st much shorter, the 5th shorter still; soles usually densely furry to the claws, but sometimes showing the under surface of the toes; plantar tubercles naked. Tail very short, its vertebræ shorter or not longer than the sole, leporine, stout, densely hairy throughout, with a copious terminal pencil, often longer than the vertebræ.

The foregoing diagnosis, so drawn as to exclude *Cuniculus*, is based upon *Mus lemmus* of Linnæus, and indicates a perfectly natural generic group of *Arvicolinæ*. From *Arvicola*, in any of its subgeneric phases, *Myodes* is prominently distinguished by external form as well as by cranial and dental characters. The general clumsy shape, very convex-obtuse head, short rabbit-like tail, short ears, small furry feet, elongated fossorial claws, and mollipilose pelage, are associated, in the skull, with breadth and massiveness, laminar expansion of the zygomatics, and a peculiar shape of the palate; and, in the teeth, with stoppage of the root of the under incisor opposite the last molar, a quill-like beveling of the upper incisors, and a particular pattern of the molar crowns. All the points of external form that mark off *Myodes* from *Arvicola* likewise separate it from *Synaptomys*; these two agreeing almost precisely in cranial and dental characters. The plane, instead of grooved, upper incisors are distinctive of *Myodes*, and so is, to less degree, a slight difference in the middle lower molar (*vide* descriptions). With *Myodes*, *Cuniculus* is generally associated generically; but we wish to particularly signalize the fact that they are perfectly distinct genera. Although both of them are "lemmings", so called; and although they do agree in general external *tournure*, yet they present differences fully on a par with those made the basis of generic distinctions in other cases. How great these differences are may be inferred, by one not acquainted with the animals, from the fact that Lilljeborg, who adopts only four genera for the whole subfamily, keeps the two apart, his genera being *Fiber*, *Arvicola*, *Cuniculus*, and *Myodes*. The comparative diagnoses are fully given farther on; here we will only add, that in *Myodes* the external ears, though small, are perfect, while *Cuniculus* has no external ears; that in *Myodes*, though the fore claws are lengthened and "fossorial", they never show the extraordinary development seen in *Cuniculus*; that the rudimentary pollex of *Myodes* bears a large ligulate nail, only faintly indicated in *Cuniculus* by an abortive thumb and claw; and, finally, that with most cranial characters in common, the pattern of the molars is very different in the two genera. Unlike *Myodes*, *Cuniculus* turns white in winter.

Like that of other genera known in early zoological times, the synonymy of *Myodes* is involved. First ranged under *Mus*, then sharing the term *Arvicola* with the rest of its subfamily, it has also had three names more particularly applied to itself—*Hypudæus* (Illiger, 1811); *Myodes* (Pallas, 1831); and *Lemmus* (Linck, 18—). *Hypudæus*, as originally framed, included *Mus lemmus*, *amphibius*, and *arvalis*, and, according to some authorities, ought to be restricted to the first species mentioned (*lemmus*); but, according to others, it is applicable to either one of the three species Illiger put in it. But it has of late been so carefully characterized by Keyserling and Blasius, in its application to *Mus rutilus*, &c., that if it is to be retained at all (which we do not think should be done), doubtless it is best assigned to *rutilus*. The choice, then, narrows to *Myodes* and *Lemmus*; we have not the authorities at hand to decide the case, but the balance of opinion is in favor of *Myodes*. Both these genera, as originally based, had a much wider application than is now admitted. In strict technical interpretation, both *Myodes* and *Lemmus* are synonyms of *Arvicola* Lacépède, 1803. *Georychus* Rich. Aud. is, of course, out of the question; Illiger's *Georychus* having been based upon an animal of an entirely different family.

Recent investigations, particularly the admirable memoir of Middendorff, have resulted in reducing the number of nominal species of *Myodes* (as above restricted) to three—*M. lemmus*, *M. obensis*, and *M. schisticolor*. There is no question of the identity of "helvolus" and "trimucronatus" of Richardson, Audubon, and Bachman; and nothing appears opposing Middendorff's view that the North American animal (including, besides the two supposed species just named, *M. albigularis* of Wagner) is the same as *M. obensis* of the Old World. Rather, the question is whether a still further reduction will not be required. It would need but a little change in coloration to transform *obensis* into *lemmus* itself; while, regarding *schisti-color*, it is a suspicious circumstance that here we have a nearly gray or slaty lemming, just as, in the case of *Cuniculus torquatus*, we have a gray one in what is called *C. lagurus*. The inference in this case is self-suggestive. But this is a question we do not propose to enter upon here; our business being simply the determination of the North American species.

## MYODES OBENSIS, Brants.

- Myodes obensis*, BRANTS, MUSEN, 1897, 55.—KEYSERLING and BLASIUS, Wirb. Europ. vi, 1840, pp. vii and 32.—MIDDENDORFF, Sibirische Reise, ii, pt. iii, 1853, 99, pl. ii, f. 7, 8, 9, and pla. viii, ix, x, f. 2.—BAIRD, M. N. A. 1857, 559.—COUES, Proc. Acad. Nat. Sci. Phila. 1874, 195.
- Arvicola* (*Georchus*) *helvolus*, RICHARDSON, F. B. A. i, 1829, 128.
- Georchus helvolus*, AUD. & BACH, Q. N. A. iii, 1853, 84, pl. cxx, f. 1.
- Myodes helvotus*, DALL, Alaska and its Resources, 1870, 577.
- Arvicola* (*Georchus*) *trimucronatus*, RICHARDSON, App. Parry's 2d Voy. 1825, 309; F. B. A. i, 1829, 130.
- Georchus trimucronatus*, AUD. & BACH, Q. N. A. iii, 1853, 85, pl. cxx, f. 2, 3.
- Myodes trimucronatus*, DALL, Alaska and its Resources, 1870, 577.
- Myodes albigularis*, WAGNER, Suppl. Schreber, iii, 1843, 602.

DIAGNOSIS.—*M. auriculatus*, pollice ungue depresso obtuso ligulato instructo, unguibus digitorum manus 3<sup>th</sup>—4<sup>th</sup> elongatis sed simplicis, pedibus modicè hirsutis, vertebrae caudæ pedibus brevioribus; notæo concolore, flavo-ferrugineo in capite obscuriore, gastræo dilutior, pedibus fuscis. *M. lemno* staturâ formâque par; long. tot. 4–6 poll., capitis 1½–1¾, manus cum ungue longissimo ¾–1, pedis ¾–1, caudæ nude 1–1½, caudæ comatæ ¾–1.

HAB.—*Americæ Septentrionalis regionibus occidentali-borealibus. Asia.*

Form strictly that of the Norway lemming; ears with a perfectly-developed conch, though small (about ½ high on the back, ¼ from the notch in front) and buried in the fur; fore feet hairy on top, the longest hairs reaching the ends of the claws, never much when any longer; palms mostly naked, nearly as in ordinary *Arvicola*, and tuberculate; pollex obsolete, but in its place a very large appressed strap-shaped claw, with obtuse or truncate end, sometimes showing two or three minute points ("trimucronatus"); all the other claws simple (never showing the peculiar quasi-duplication of those of *Cuniculus torquatus*), arched, acute, longer than in *Arvicola*, never so decidedly fossorial as in *Cuniculus*; third finger longest, fourth nearly as long, second reaching to base of third claw, fifth much shorter still; hands, including claws, only about ½ the feet; feet above, like the hands, hairy to the ends of the claws, or the longest hairs slightly surpassing the claws; soles incompletely furry, the bases of the toes naked; second, third, and fourth toes subequal and longest; fifth about reaching base of fourth; second shorter still. Tail-vertebræ shorter than foot, with the hairs equal to or rather longer than foot; copiously comous, the terminal pencil frequently longer than the vertebral portion. Pelage long, fine, soft, and mollipilose, the longer hairs quite lustrous; whiskers about equaling the head, very delicate, not numerous; muffle completely hairy except the nasal papillæ.

Entire upper parts uniform rich ruddy rust color, sometimes more



decidedly rusty-chestnut, sometimes more rusty-orange or tawny; on the head darker, tending to an intimate mixture of blackish and yellowish-brown; under parts a paler but still strong orange rust color or tawny, brightest across the belly, more dilute and whitish-brown on the chin, throat, and pubes; color of the back lightening insensibly into that of the belly; no stripes, spots, or areas of different colors anywhere; no evident mixture even of single black hairs anywhere; the coloration everywhere only on the ends of the hairs, the basal portions being uniformly dark plumbeous. Feet always fuscous-brown; tail dusky above, obscurely whitish below; incisors whitish or very pale yellowish, never deep yellow or red; whiskers both light and dark.

Our numerous specimens, though taken at various seasons, are remarkably uniform in color; the variation is less than we should have anticipated. We observe no sign of the species becoming white in winter, or of its changing pelage in any way with age, sex, or season. All the differences we note are in intensity of the coloration. In the most richly-colored skins, the back is an intense orange-chestnut, the belly a bright rusty-orange; in the palest, the upper parts are about of this latter color, the under of a lighter fulvous. There is no variegation or particoloration anywhere about the animal, but toward and on the head the bright color subsides into a grizzle of dusky and yellowish-brown. The uniformly fuscous feet with short hairs are a strong character, compared with the hoary-white feet of *Cuniculus torquatus*, where the longest hairs sometimes reach half an inch beyond the claws.

The American animal, as represented in our series, differs notably in color from two Siberian skins, the only ones we have before us. In these, the under parts are nearly white (soiled ochrey-white) below, instead of intense tawny; while the upper parts are far from uniform orange-rusty, in having a decided black median lengthwise stripe from the forehead over the crown and nape, while here and there on the back and rump quite black areas appear. The feet are broader, heavier, and more densely furry, nearly white. If these differences be constant, we may readily recognize the American animal as at least a variety, to be called *Myodes helvolus*. But with only two specimens before us that may not represent average Siberian skins, and certainly cannot show the variations there occurring, we are far from desiring to contest von Middendorff's mature decision.

The following table gives the measurements of our fine *suite* of skins,

the first and only American specimens handled in this country since the time of Richardson.

TABLE LX.—Measurements of thirty-two specimens (dry, except 8308-9) of *MYODES ORENSIS*.

Number.	Sex.	Date.	Locality.	Collector.	From tip of nose to—				Tail to end of—				Remarks.
					Eys.	Ear.	Occiput.	Tail.	Vert.	Hair.	Fore feet.	Hind feet.	
1973			East Siberia .....	Mus. St. Petersburg	0.65	1.40	0.50	.....	0.50	0.75			Stretched.
1406			Taimyr-land, Siberia..	Museum Bremen	.....	.....	4.75	.....	.....	.....			
5083			Frøbie's Straits.....	O. F. Hall	.....	.....	4.60	0.35	0.60	0.45	0.70		
5084			do .....	do	.....	.....	3.50	.....	.....	.....			Young.
7104			Peele's River .....	O. P. Gaudet	.....	.....	4.75	0.40	0.70	0.40	0.60		
6062			Arctic Coast.....	R. McFarlane	.....	.....	3.75	.....	.....	.....			Young.
6928			Anderson River.....	do	0.55	1.10	1.25	4.50	0.40	0.70	0.40	0.75	
6929			do .....	do	.....	.....	4.25	0.45	0.80	0.45	0.70		
6836			do .....	do	.....	.....	3.25	.....	.....	.....			Young.
6930			do .....	do	.....	.....	4.25	0.40	0.80	.....			
8076		June 11, 1893	Fort Anderson .....	do	.....	.....	3.00	.....	.....	.....	0.40	0.75	
8079		June 11, 1893	do .....	do	.....	.....	4.50	.....	.....	.....			
8080		June 14, 1893	do .....	do	.....	.....	.....	0.35	0.60	0.35	0.65		
8081		June 14, 1893	do .....	do	.....	.....	.....	0.50	0.80	0.37	0.68		
8082		June 14, 1893	do .....	do	.....	.....	.....	4.25	0.30	0.70	0.40	0.73	
8083		—, 1893	do .....	do	.....	.....	.....	4.50	0.30	0.60	0.41	0.74	
8084		—, 1893	do .....	do	.....	.....	.....	4.40	.....	.....	.....	0.73	
8161	♀	June 24, —	do .....	do	0.55	1.15	1.30	4.60	0.45	0.75	0.36	0.67	
9109		Oct. —, 1893	do .....	do	.....	.....	4.00	.....	.....	.....	0.35	0.66	
8308		Oct. —, 1893	do .....	do	0.47	0.85	1.15	3.60	0.35	0.75	0.40	0.70	Alc.; ear 0.33.
8309		do .....	do .....	do	0.50	1.00	1.25	4.00	0.50	0.90	0.40	0.73	do.
8076		June 10, 1893	Yukon River*	J. Lockhardt	0.60	.....	5.75	0.35	0.60	0.35	0.68		Stretched.
8077		June 10, 1893	do .....	do	0.50	1.15	1.25	3.00	0.40	0.80	0.40	0.78	
8925		May —, 1890	do .....	do	.....	.....	6.50	0.30	0.70	0.45	0.78		Stretched.
8926		Spring, 1891	do .....	R. Kennicott	.....	.....	7.50	0.45	0.80	0.40	0.74		Much stretched.
6929		June —, 1891	do .....	do	.....	.....	5.75	0.35	0.80	0.45	0.88		
6930		June —, 1891	do .....	do	.....	.....	6.50	0.35	0.85	0.40	0.73		Stretched.
6931		May —, 1891	do .....	do	0.62	1.20	1.35	3.00	0.35	0.60	0.30	0.70	
6932		June —, 1891	do .....	do	.....	.....	5.75	0.45	0.80	0.45	0.80		Stretched.
6933		May —, —	do .....	do	0.60	1.25	1.40	3.00	0.45	0.85	0.44	0.80	do.
6934		June —, —	do .....	do	.....	.....	5.75	.....	.....	.....	0.73		do.
6934	♂	April —, —	do .....	do	.....	.....	3.30	.....	.....	.....	0.45	0.68	Young; fresh.

\*At mouth of Porcupine River.

## GENUS CUNICULUS, Wagler.

*Mus* sp., *Arct. antiq.**Arvicola* sp., *Myodes* sp., *Lemmus* sp., *Arct. recentior*.*Georchus*, partim, RICHARDSON; AUD. & BACH. *neo ILLIG.**Cuniculus*, WAGLER ("Syst. 1830"), Lais, 1832, 1890. (Type, *C. grandis* = *C. torquatus*).—LILLJEBORG, Syst. Öfvers. Gnog. Diggd., Gllire, 1866, 23 (*same type*).—COUES, Proc. Acad. Nat. Sci. Phila. 1874, 196.*Miothermus*, HENDEL, Zeits. Deutsch. Zool. Ges. vii, 1855, 492 (*same type*).

CHARS.—Skull lower, broader, more massive than in *Arvicola*, rather less so than in *Myodes* (zygomatic width not  $\frac{1}{2}$  the length), but in general char-

acters closely conforming to the last named. Palatal shelf as in *Myodes*; zygomata much less laminar than in *Myodes* (nearly as in the larger *Arvicole*). Nasals and nasal branch of premaxillaries subequal; both very short, ending opposite anterior root of zygomata. Orbits less encroached upon by the cranial dome than in *Myodes*, but having a prominent pointed process for muscular attachments. Superior incisors as in *Myodes*; and likewise as in that genus, roots of under incisors stopping opposite back under molars. Molar series long and strongly convergent anteriorly, as in *Myodes*, but the pattern of the crowns entirely different and strongly arvicoline, as follows:—Front upper molar of seven (five in *Myodes*) prisms: an anterior transverse spherical triangle, three internal lateral triangles, two external lateral triangles, and a (small, supplementary) postero-external loop. Middle upper molar of six prisms (four in *Myodes*): an anterior transverse loop, two external lateral triangles, two interior lateral triangles, and a (small, supplementary) postero-external loop. Back upper molar of six prisms: an anterior transverse loop, two external and two internal lateral triangles, and a posterior trefoil, or V or U. Front under molar of nine prisms (five in *Myodes*): an anterior trefoil, three external lateral triangles, four internal closed triangles, and a posterior transverse loop. Middle and back under molar each of five (or five and a half) prisms: an antero-external triangle (with a more or less evident anterior lobe abutting against the back loop of the antecedent tooth), two internal lateral triangles, one external lateral triangle, and a posterior transverse loop. All the lateral triangles of all the teeth alternating. External form stoutest and most compact in the subfamily; limbs the shortest; no external ears; muffle completely hairy except the very papillæ; pelage dense and woolly; feet short, stout, both fore and hind completely furry both above and below, the longer hairs reaching usually far beyond the ends of the claws; pollex obsolete, with abortive nail; third and fourth digits much longer than second and fifth, their claws periodically hypertrophied and quasi-duplicated by an enormous growth of corneous substance on their under surface; hind claws ordinary; tail to end of vertebræ shorter than the hind foot, but copiously comous, the terminal pencil usually longer than the vertebral moiety. Coloration subject to periodical changes: dark and variegated in summer, snow-white in winter.

As will be seen by the above, the cranial characters and those of the incisive dentition are very nearly the same as in *Myodes*, but that the pattern

of the molars is totally different. In this latter respect, *Cuniculus* stands quite alone, for it differs as much from *Arvicola* as from *Myodes*. There is little occasion to enlarge upon the molar characters above given, but some further general remarks may not be out of place. In *Cuniculus*, the lateral saliences are all sharp, the lateral triangles being long and narrow, and the median zigzag line of enamel runs nearly along the middle line; this is nearly as in ordinary *Arvicola*; while in *Myodes* one or the other (the external in the under jaw, the internal in the upper) of the series of saliences are obtuse, and the median zigzag, besides being unusually tortuous, runs nearer one side of the molar series than the other. An increase of the number of triangles of all the teeth occurs. Thus, in American *Arvicola* the front lower molar has at most three internal and two or three external lateral triangles, and *Myodes* has but two internal and one external; here in *Cuniculus* there are four internal and three external, making, with the anterior trefoil and posterior loop, altogether six internal saliences and five external ones. The back upper molar of *Cuniculus* is nothing at all like *Myodes*; in the latter, we have four loops, all transverse, one after the other, while in *Cuniculus* there is an anterior loop and a posterior trefoil (as in *Pedomys*, *Pitymys*, &c.), separated by two external and two internal lateral triangles, alternating with each other. The anterior upper molar, the most constant tooth throughout *Arvicola*, and even in *Myodes* scarcely differing from *Arvicola*, here is unique in possession of seven prisms; the two additional ones to the five of *Arvicola* and *Myodes* being another internal lateral one, and after this a small supplementary postero-external loop. Similarly, the middle upper molar adds to the four or four and a half of *Arvicola* and *Myodes* an extra internal lateral one and a small supplementary external loop. Of the front upper molar of *Cuniculus*, the first lateral triangle is an interior one; of the second upper molar, the first lateral triangle is an exterior one. The middle and back under molars of *Cuniculus* are correspondingly more complicated, having five or five and a half prisms, the lateral of which alternate with each other; of the front under molar, the first lateral triangle is an interior one; the back lower molar is a little narrower than the antecedent one. In the upper molar series, altogether, there are twelve external salient points and eleven internal salient points; in the under-molar series, altogether, there are twelve internal salient points and eleven external salient points. But however minute we may thus make our account of the dentition of *Cuniculus* as differentiated from that of either

*Myodes*, or *Arvicola* at large, it will be better understood by simply laying the different skulls side by side, and looking at the teeth with a pocket-lens.

Externally, although *Cuniculus* shares the "lemming" shape of *Myodes*, it is instantly distinguished by the absence of external ears, the shortness and dense furring of the feet, the obsolete pollex with rudimentary nail, and the prodigious length of the two middle fore claws, whose size is often more than doubled by the singular growth already mentioned. As to the absence of ears, there is indeed a rim or border around the opening, but it cannot be called an auricle.

We have in America but one species of *Cuniculus* as far as is known; it is identical with that of Northern Asia. Of the relationships of the supposed second species, *C. lagurus*, we can say nothing, having seen no specimens; but, as already intimated, we believe its validity to be open to question.

#### CUNICULUS TORQUATUS, (Pall.) Coues.

- Mus hudsonius*, PALLAS, N. Sp. Quad. Glirium, 1778, 208, pl. xxvi, figs. A, B, C. (quotes FORSTER, Phil. Trans. Lxii, 1772, 379).—GMELIN, Syst. Nat. i, 1788, 137.  
*Lemmus hudsonius*, SABINE, Suppl. Parry, App. 1824, 185.—SABINE, Franklin's Journ. App. 1825, 661.—HARLAN, Fu. Amer. 1825, 546.  
*Arvicola hudsonia*, RICHARDSON, App. Parry's 2d Voy. 304.  
*Arvicola* (*Georychus*) *hudsonius*, RICHARDSON, F. B.-A. i, 1829, 132.  
*Myodes hudsonius*, WAGNER, Suppl. Schreber, iii, 1843, 604.—MIDDENDORFF, Bull. Acad. Imp. St.-Péter. iii, xix.—Wiegmann's Archiv, 1845, Bd. ii, 34.—DALL, Alaska and its Resources, 1870, 577.  
*Georychus hudsonius*, AUD. & BACH., Q. N. A. 1853, iii, 81, pl. cxix.  
*Cuniculus hudsonius*, COUES, Proc. Acad. Nat. Sci. Phila. 1874, 196.  
*Mus torquatus*, PALLAS, N. Sp. Quad. Glirium, 1778, 77 and 206, pl. xi, B.—GM., Syst. Nat. i, 1788, 136.  
*Myodes torquatus*, KEYSERLING & BLASIUS, Wirbelth. Europ. 1840, pp. vii and 32.—MIDDENDORFF, Sibir. Reise, ii, pt. ii, 1853, 87, pl. iv-vii and x.—BAIRD, M. N. A. 1857, 558.—BLACKM. & ALSTON, P. Z. S. 1874, 469.  
*Miothermus torquatus*, HENSEL, Zeits. Deutsch. Geol. Ges. vii, 1855, 492, pl. xxv, figs. 12, 13.  
*Mus leucensis*, PALLAS, N. Sp. Quad. Glirium, 1778, 195.  
*Mus grælandicus*, TRALL, Scoresby's Greenland, 1823, 416.—RICHARDSON, App. Parry's 2d Voy. 304.  
*Arvicola* (*Georychus*) *grælandicus*, RICHARDSON, F. B.-A. i, 1829, 134.  
*Cuniculus grælandicus*, AUD. & BACH., Q. N. A. 1854, iii, 315.  
*Cuniculus grælandicus*, WAGLER, Isis, 1832, 1220.  
*Myodes grælandicus*, WAGNER, Suppl. Schreber, iii, 1843, 606.—GRAY, P. Z. S. xvi, 1848, 43, and Rae's Narrative, 1850.—DALL, Alaska and its Resources, 1870, 577.  
*Lemmus ungulatus*, BAER, Baer and Helmersen, Beiträge, iv, 1841, 283.  
*Hudson's Rat* and *Hare-tailed Rat*, PENNANT, Arch. Zool. i, 1787, 139, 133; Quad. ii, 201.  
*Hare-tailed Mouse*, HEARNE, Journ. 387.  
*Hudson's Bay Lemming*, AUCT.  
*Wapikooseenck* ("White Bear-Mouse"), Cree Indians.—*Lunaguy* ("White Mouse"), Chippewayans.—*Awingnack* ("White Mouse"), Esquimaux. (Label of No. 7755.)

DIAGNOSIS — *C. exauriculatus*, pollice obsoleto, unguib. digitorum manūs 3<sup>ta</sup>–4<sup>ta</sup> maximis, bimucronatis, quasi-duplicatis; pedibus hirsutissimis; caudā pedibus breviorē; vestitu æstivali supra castaneo nigro et griseo aut luteo varie-

*gatus, plerumque strigâ nigrâ spinali, et interdum torque nuchali pallida; subtus ex albido ferrugineus; hyemali ex toto niveus. Long. tot. 4-6 poll., capitis 1½, caudæ nude ½, caudæ comatæ 1, mandis cum ungue longissimo ¾, unguis longissimi hyemalis ½, pedis ¾.*

HAB.—Arctic America, Greenland, and corresponding latitudes in the Old World.

With the *form*, &c., typical of the genus as above fully described.

*Summer*.—Taking an average specimen, the upper parts present an intimate dapple of chestnut or rusty-red, black, gray, and luteous, producing a variegation known as "watered". On the fore back and shoulders, the rufous color prevails; on the lower back, rump, and haunches, the black and gray grizzle predominates. In general, there is a pretty distinct black line along the middle of the back from the muzzle to the tail; but this, though usually recognizable even when not sharp, is often dissipated in the general variegation of the upper parts. Very often, there is a recognizable grayish-white or luteous-white collar across the nape, rendered a little more evident by being bordered both before and behind by rufous more intense than elsewhere. But this collar is frequently obscure or altogether indistinguishable. When thus not recognizable, an incomplete rufous band is still frequently present, arising from the imperfect confluence across the occiput of two rufous spots that mark the situation of the ears. Underneath, the ground-color is grayish-plumbeous, as usual; next to this comes a grayish-white, and over this is washed a strong shade of rusty or rufous. The chin and throat are the grayest or palest; next usually comes the lower belly, where the rusty wash is uniformly laid on; then the breast and epigastrium are more heavily rusty or rufous. The feet and tail appear to be uniformly white or whitish at all seasons. Even in summer, all the feet are always densely clothed, the entire palms and soles being furry like a rabbit's, and on top the long hairs reaching beyond (sometimes half an inch beyond) the ends of the claws.

Independently of the regular seasonal changes, the particular hue of the upper parts varies in a way that defies description. Taking, however, two extremes, of rich dark coloring and pale blended shades, we find that in the former case the upper parts are dappled with uniform deep mahogany color and glossy black, these then speckled all over with nearly pure white, the spinal stripe intense black; and the under parts are correspondingly sharp. In the other extreme, there is no such sharp hue, the animal above being a nearly

uniform rizzle of gray, black, and luteous or fulvous, and below muddy-gray, rustier on the breast. It may be, indeed, that these differences are somewhat regular and seasonal, as well as the change to white; but as few of our specimens are marked for season, we cannot make this out. As, however, several of our richest-colored skins are spring and early summer ones, we judge that, with the disappearance in spring of the white winter-coat, the brightest, sharpest pelage is put on, the vividness of the rufous or mahogany attaining a maximum in the breeding-season, or rather a little afterward, in midsummer; and that subsequently the hues grow cooler and more intimately mixed, until at length in the fall the whitening becomes manifest.

*Winter.*—In perfect dress, the animal is pure white all over. In the fall, the whitening seems to begin underneath and on the sides, to progress then over the lower back; the heavy color of the upper back and breast being the last to yield. Several specimens are white, with a narrow dorsal area of color, that spreads forward over the upper back and shoulder, and underneath still tinges the breast; others are curiously white, with lateral rufous stripes that nearly meet on the rump and then curve round the sides to the chest; others are pure white, except a sharp spinal stripe of grayish-black; some are white, uniformly tinged with pale rufous all over. But it would be idle to attempt an enumeration of all the intermediate stages; although, in the midst of apparently interminable changes, doubtless rules of very general applicability may be deduced from observation of a few hundred specimens accurately marked for season.

The two middle fore claws attain their maximum of development in winter. In spring and early summer, these claws do not appear very different from those of *Myodes*, though averaging larger, more bulbous at base underneath, with the terminal portion slenderer, straighter, and sharper. This bulbous portion underneath grows out simultaneously with increase in length and amount of curvature of the main portion of the claw, until it equals or even exceeds the length of the latter, and is quite as stout, or even stouter, being somewhat broad and pad-like. At this period, it runs the whole length of the claw, from which it is separated by a groove along the sides, and by a notch at the end, both of varying depth. The claw then looks nearly like two claws, one underneath the other. The pad would then seem to gradually sever its connection with the main claw by progressive increase of the constriction marked by the lateral groove and terminal notch, as well as by loos-

ening from the base, when it appears like an excrescence; it is finally lost. Thus the process appears to be a periodical one, like the shedding of the horns of ruminants, and not continually progressive with age; and would seem to be connected with the particularly fossorial habits of the quasi-hibernating animal that digs galleries under ground in which to reside during the cold season, as compared with its freer and more active mode of life in summer. At the period of the maximum development of the claws, these equal or surpass half an inch in length, and yet the hairs upon the dorsum of the fore feet reach to or even beyond their tips. At the same season, the hairs upon the hind feet form a fringe drooping far beyond the ends of the claws, and the terminal pencil of hairs on the tail is almost invariably longer than the vertebral portion. The winter-coat is much longer and thicker than that of summer; the difference is well shown in those intermediate specimens that are white and woolly, yet with definite stripes of shorter, thinner, colored hairs.

Audubon's plate of the summer pelage is highly erroneous, representing a uniformly rusty-red animal instead of a dappled and otherwise variegated one. The coloration as given is, in fact, exactly as in *Myodes helvolicus (obensis)*, whereas the two are distinguishable on sight by color alone. His figure of the winter pelage is very good, representing, however, an animal not perfectly white.

There is no question of the identity of the American and Asiatic animal.

In an abstract of the present memoir, already published in the Proceedings of the Philadelphia Academy, we cited Forster as authority for the name *Mus hudsonius*, quoting at second hand, the volume of the Philosophical Transactions not being conveniently accessible at the time. On turning to the page indicated, we find that Forster gives no such name; he merely describes a mutilated specimen from Churchill River, of "a small animal called a Field Mouse" Pallas is the author of the name *Mus torquatus*, at date 1778; but it is "antedated" by the same author's *Mus torquatus*, described on preceding pages of the same work. The species will consequently stand as *Cuniculus torquatus*. *Mus lenensis* Pallas is the same animal, of same date. *Grœnlandicus* and *ungulatus* are later names of nominal species.

The following table of measurements of our excellent series shows the size and, to a considerable extent, the variations of the species, but does not



appear to call for comment, as the differences are parallel with those demonstrated for several species in other parts of this memoir.

TABLE LXI.—Measurements of sixty-eight (and list of other) specimens of *CUNICULUS TORQUATUS*.

Number.	Locality.	Collector.	Nose to—			Tail to end of—		Fore foot.*	Hind foot.	Remarks.
			Eye.	Ear.	Occiput	Tail.	Vert.			
1973	Novaja Semlja	Museum St. Petersburg.	.....	.....	.....	3.75	0.60	1.40	0.75	Summer; dry.
4384	Arctic America	Alfred Newton†	.....	.....	.....	1.52	.....	.....	.....	.....do.
1865	Hopedale, Labrador.	.....do.†	.....	.....	.....	3.35	0.50	1.00	0.65	Grayish-white.
4384	Fort Churchill, IL B.	W. Macdavia	.....	.....	.....	3.00	0.40	0.75	0.75	Pure white; claw 0.45.
4292	.....do.	.....do.	0.60	1.30	.....	3.00	0.35	0.85	0.50	Summer.
4303	.....do.	.....do.	0.50	.....	.....	4.75	0.35	0.60	0.50	.....do.
7753	.....do.	.....do.	0.50	0.90	1.15	3.40	0.30	0.65	0.4	Alcoholic; summer.
7755	.....do.	.....do.	0.55	1.00	1.25	4.85	0.45	1.00	0.70	Alc.; Feb. 2, 1859; nearly white.
7756	.....do.	.....do.	0.65	1.25	1.35	4.50	0.40	0.90	0.42	Alcoholic; July, 1859.
8359	.....do.	.....do.	3.00	1.10	1.40	3.85	0.30	0.70	0.65	Alcoholic; winter; white.
8360	.....do.	.....do.	0.56	1.08	1.35	1.75	0.45	1.00	0.65	.....do.
8361	.....do.	.....do.	0.62	1.05	1.30	4.75	0.45	0.80	0.65	.....do.
8362	.....do.	.....do.	0.58	1.03	1.30	3.85	0.40	0.80	0.65	.....do.
8363	.....do.	.....do.	0.58	0.90	1.20	4.10	0.50	0.90	0.65	Alcoholic; winter†; nearly white.
8364	.....do.	.....do.	0.57	1.03	1.30	1.05	0.40	0.85	0.65	Alcoholic; winter†; partly white.
8380	.....do.	.....do.	0.60	1.10	1.40	1.60	0.30	0.75	0.65	Alcoholic; summer.
8943	Nulato, Alaska.	W. H. Dall	.....	.....	.....	1.75	0.25	0.50	0.40	Summer.
9402	Woollysxax, Alaska.	.....do.	0.50	1.00	1.20	4.50	0.40	0.75	0.65	Summer; still whitish.
9451	Fort Yukon	W. W. Kirkby	.....	.....	.....	1.50	0.35	0.75	0.50	White, with gray stripes.
10335	Arctic America.	.....do.	.....	.....	.....	.....	.....	.....	.....	White.
8762	Yukon, mouth of Porcupine River.	J. Sibbiston.	.....	.....	.....	3.00	0.40	0.90	0.60	Summer; perfect pelage.
8993	.....do.	J. Lockhart	.....	.....	.....	4.00	.....	.....	0.50	June; still rusty-white.
8992	.....do.	.....do.	.....	.....	.....	3.95	.....	.....	.....	June; young.
6924	Rocky Mountains, near Peel's River.	.....do.	.....	.....	.....	3.00	.....	.....	.....	July; young.
6950	Mountains 900 miles above Yukon.	.....do.†	0.55	0.95	1.05	3.75	0.35	0.85	0.55	September; a little whitened.
6351	.....do.	R. Kennicott.	.....	.....	.....	.....	.....	.....	0.55	October; pure white.
6354	Mouth of Mackenzie's River.	.....do.	.....	.....	.....	4.25	0.40	1.00	0.55	—†; whitening.
6953	.....do.	.....do.	.....	.....	.....	4.00	0.30	0.90	0.50	Almost pure white.
8086	Arctic Coast.	R. McFarlane.	.....	.....	.....	1.50	0.50	1.00	0.50	Summer; normal pelage.
8087	.....do.	.....do.	.....	.....	.....	4.75	0.35	0.90	0.4	—†; much whitened.
8088	.....do.	.....do.	.....	.....	.....	4.75	0.35	0.70	0.55	Summer; normal pelage.
8089	.....do.	.....do.	.....	.....	.....	4.90	0.40	0.90	0.50	Winter; nearly white.
8090	.....do.	.....do.	.....	.....	.....	4.25	0.30	0.65	0.5	Changing pelage.
9111	.....do.	.....do.	.....	.....	.....	4.75	0.40	0.80	0.50	Normal summer-pelage.
9221	.....do.†	.....do.	.....	.....	.....	4.75	.....	.....	0.45	Winter; perfectly white.
9225	.....do.†	.....do.	.....	.....	.....	3.50	0.40	0.75	0.50	Win.; exactly like Audubon's pl.
7176	Anderson River.	.....do.	.....	.....	.....	5.50	0.40	1.00	0.55	Winter; nearly pure white.
7177	.....do.	.....do.	.....	.....	.....	4.75	.....	.....	0.60	Winter; perfectly snow-white.
8005	Barren Grounds.	.....do.	0.52	1.10	1.20	4.25	0.30	0.60	.....	♂; June 30; perfect pelage.
8134	.....do.	.....do.	0.55	1.10	1.30	5.00	0.40	1.00	0.57	♀; June 26; perfect pelage.

\* From wrist to end of longest claw.

† Received from: No. 4894, collected by IL B. M. S. Enterpriso.

‡ Lockhart says: "Cheek-pouches filled with seeds."

§ Found in the nest of an *Archibuteo* (McFarlane).

TABLE LXI.—Measurements of sixty-eight (and list of other) specimens of CUNICULUS TORQUATUS—Cont'd.

Number.	Locality.	Collector.	Nose to—				Tail to end of—		Hind foot.	Remarks.
			Eye.	Ear.	Occiput.	Tail.	Vert.	Hairs.		
8156	Barren Grounds.	R. McFarlane.	0.50	1.05	1.25	4.25	0.32	0.90	0.63	♂; June 26; perfect pelage.
8157	do	do				4.50	0.40	1.00	0.64	♀; June 26; perfect pelage.
8159	do	do				4.50	0.35	0.90	0.62	♀; June 26; perfect pelage.
8955	Anderson River.	do				5.00	0.30	0.85	0.53	Pure white, with dark spinal stripe.
8956	do	do				5.00	0.40	1.00	0.53	Changing pelage.
8957	do	do				4.75				do.
8959	do	do				5.25			0.50	do.
8960	do	do	0.50	1.05	1.20	3.25	0.40	0.80	0.60	do.
8153	do	do							0.58	July 4; perfect pelage.
9234	do	do	0.51	1.00	1.20	4.25			0.55	June; perfect pelage.
8994	Fort Anderson.	do				4.00	0.35	0.75	0.60	Entirely white.
8997	do	do				5.00	0.30	0.80	0.65	do.
8781	do	do				3.50			0.57	May 29; summer pelage nearly perfected.
8996	do	do				4.75			0.60	Summer; perfect pelage.
8155	do	do	0.50	1.10	1.20	4.50	0.40	1.00	0.55	June 6; perfect pelage.
8998	do	do				4.00	0.30	0.85	0.58	—; nearly perfect pelage.
8101	do	do				4.25			0.55	do.
8104	do	do				4.75			0.54	do.
8103	do	do				4.50	0.40	0.75	0.52	Summer; perfect pelage.
8108	do	do				4.75	0.45	0.95	0.52	do.
8100	do	do				3.50	0.40	1.00	0.58	June 7; very rich colors.
9153	do	do							0.55	Young.
9176	do	do							0.57	do.
9206	do	do								do.
9237	do	do							0.46	Young.
9238	do	do				4.25	0.35	0.85	0.65	Winter; perfectly white.
9239	do	do				4.00	0.25	0.65	0.53	Summer pelage.
9230	do	do				4.50	0.30	0.80	0.50	do.
9231	do	do				7.00	0.40	1.25	0.60	Summer pelage; greatly stretch'd.
9232	do	do	0.63	1.35	1.55	6.00			0.65	Summer pelage; much stretched.
9233	do	do	0.60	1.25	1.40	5.50	0.35	1.00	0.58	Summer pelage.
9234	do	do	0.55	1.10	1.30	5.25	0.40	1.10	0.58	do.
10981	do	do				4.00			0.65	Winter; almost white.

\* Contained 5 embryos (McFarlane).

## Genus FIBER, Cuvier.

< *Castor*, LINN., Syst. Nat. i, 1766, 78.< *Mus*, GM., Syst. Nat. i, 1788, 125.X *Myocastor*, KERR, "L. S. N. 1792 (type *Myopotamus coxus*)."= *Fiber*, CUV., "Leçons, i, 1800 (type *Castor sibiricus*)."= *Lemmus*, FISCHER, Syn. 1829, 280.= *Ondatra*, "LACÉPÈDE."—LESS., Man. 1827, 286 (type *Castor sibiricus*).

CHARS.—Largest of the family. Form arvicoline, but tail nearly as long as body without head, compressed, nearly naked, reticulate. Hind feet set obliquely; soles naked, quasi-tuberculate; toes incompletely webbed. Fore arm bristle-fringed. Muzzle hairy, except the nasal pads. Ears small, with

prominent angular antitragus. Whiskers short. Pelage lanuginous, beset with numerous long, glossy hairs. Mammaræ six. Highly developed perinaeal glands. Dentition strictly arvicoline in every respect; \* skull thoroughly arvicoline; but squamosals greatly expanded, with corresponding reduction of parietals and interparietal; interorbital constriction of frontal at a maximum; anterior border of outer wall of anteorbital foramen wholly underneath the root of the zygoma. An angular process of squamosal overhanging orbit behind; zygomatic spur of squamosal touching zygomatic process of maxillary; jugal a mere splint applied internally.

*Fiber* is a true arvicoline, showing every essential character of the subfamily as distinguished from *Murinae*, and presenting no features of more than generic grade. Its cranial and dental characteristics depart but little, and only in superficial respects of mere contour; while its more considerable external modifications relate entirely to the highly aquatic habits of the animal. In the upper jaw, the first molar has an anterior triangle, two interior and two exterior triangles, alternating, the first interior following the anterior one. The second molar has an anterior, an interior, and two exterior triangles, alternating, the first exterior following the anterior one. The back molar has an anterior, then an exterior, then an interior triangle, finishing with a simple posterior U-, V-, or Y-shaped treffle. In the lower jaw, the first molar, which is wider than, and nearly as long as, the other two together, consists of an anterior treffle, three exterior and four interior triangles, and a posterior loop across the tooth; but the anterior pair of these lateral triangles do not always close up, so that they frequently resemble mere lobes of the anterior treffle, leaving but two exterior and three interior perfectly closed triangles. The middle molar consists of two exterior and two interior alternating closed triangles and a posterior transverse loop. The back molar repeats the middle one, but is still smaller, and the first (antero-exterior) triangle may be a mere spur, or obsolete. The upper incisors describe an almost perfect semicircle in the jaw; their face is plane, very oblique; they are deeply beveled behind by attrition with the under incisors; these traverse the lower jaw to the root of the condylar process. The jaw is massive; the coronoid is on a level with, or overlaps, the condyle; the descending process is hamular, as usual, and much twisted.

\* Audubon (l. 107) notices some singular errors authors have committed in describing the dentition; Illiger, Griffith, Wiegmann, and Ruthe assigning the molars  $\frac{4-4}{4-4}$

The stout zygomata do not dip down nearly to the palatal plane; the maxillary plate supporting them in front is large; behind, they curve up to the squamosals with moderate angularity. The arch is expanded in the middle, much as in the Lemmings and the stouter Arvicolas, chiefly by the laminar character of the jugal at this point; but the jugal is a mere splint, not forming by itself any part of the continuity of the arch, for the squamosal and maxillary spurs are absolutely in contact. This is a strong point of *Fiber*, for in other Arvicolines these spurs, however closely approximated, do not suturally unite. The parietals and interparietal are at a minimum size, coincident with the encroachment of the highly developed squamosals; behind, the squamosal vacuities are large; in front, this bone protrudes as an angular process into the orbital space, but this is merely an exaggeration of the smaller protuberance of other *Arvicoline*. The constriction of the frontal in the interorbital region is at a maximum, the skull being here obviously narrower than the rostrum. The nasals and intermaxillaries are of about equal lengths; neither extend beyond the anterior root of the zygoma. In the adult, the occipital bone shows no trace of its elements; the paroccipital processes are lengthened spurs; the upper border of the bone forms, with the continuous squamosal border, a strong sinuate crest, separating the parietal from the occipital plane. The foramen magnum is usually emarginate superiorly. The auditory bullæ are not peculiar. The palate ends behind opposite the middle of the last molar as a doubly emarginate shelf, showing a median azygos protuberance with a fossa on either side; it shows likewise other lateral fossæ or canals along its surface. The incisive foramina are relatively short and constricted; they rarely, if ever, reach to opposite the molars behind, nor more than two-thirds the distance thence to the incisors in front. The rostrum is tumid and obtuse, the nasals falling far short of a perpendicular tangent to the incisors. In all this, it will be observed, *Fiber* shows slight specialization of ordinary arvicoline characters.

Externally, however, the modifications are stronger, in face of special habitus. The under fur is even more woolly than in the Lemmings, and the pelage is further conspicuous for the many stiff and glistening hairs with which it is beset; besides these, the antibrachium has a peculiar fringe of still stiffer bristles. The sides of the hands and feet are likewise fringed with hairs, but the soles and palms are perfectly naked; above, these members are closely pilous with very short adpressed hairs. The palms have five tuber-

cles, as usual; the soles, on the contrary, only four—one long, lengthened, postero-internal, and three others at the bases of the 1st, 2d, and 4th-5th toes. The skin of the soles is not granular nor obviously reticulate, though it is crossed with lines in the dried state. The 1st toe is but little shorter than the 5th, the claw of which falls short of that of the 4th; this last is rather the longest, the 3d and 2d decreasing a little. The rudimentary thumb bears a claw; the other fore digits are subequal in length, and all long. As in many other aquatic mammals, the whole foot is set obliquely on the leg, so that its edge and not its surface may be opposed to the water in the forward movement of the member, and *vice versa*. The modification of the tail into the semblance and for the purpose of a rudder is the most remarkable feature of the animal. This member is strongly flattened sideways in nearly all its extent, permitting readiest lateral flexion and but little up-and-down movement. The vertical width of the tail is increased by a fringe of stiffish hairs above and below; on the sides, the skin is almost naked, and cut into numberless scales, showing a disposition to form the rings so conspicuous in *Mus*; but their annular alignment is not perfect, the general arrangement being nearer a quincunx. The ear does not show such development of the antitragus, or other mechanism for excluding water, as might have been anticipated; but it is so small, so furry, and so deeply buried in the general pelage, that no additional contrivance is required. The eye is very small; the muffle, completely furry except on the small nasal pads, is very obtuse, with thick fleshy lips, not cleft at the median septum; there are fleshy enlargements and hairy patches within, serving to diminish the oral aperture. The whiskers are short, sparse, and stiff; there are other bristles over the eyes and under the chin.

#### FIBER ZIBETHICUS, (L.) Cuv.

##### Muskrat.

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## HABITAT.—North America.

Having already given, under head of the genus, a sufficient description of the only recognized species, we do not consider it necessary to enter into further detail respecting so well-known an animal, concerning which we have no new information to offer.

## BIBLIOGRAPHICAL APPENDIX.

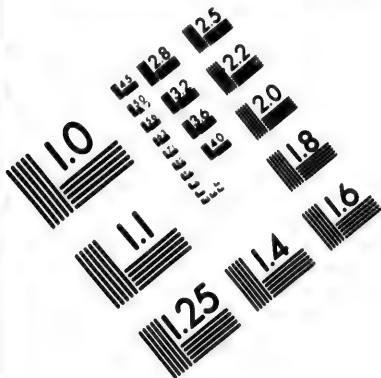
[NOTE.—Besides the numerous general treatises already cited as bearing in due part upon North American *Muridae*, the following special works and papers relating to the *Muridae* at large may be noted. The American literature of the subject is believed to have been very fully indexed; otherwise, the list is supposed to be far from complete. Many of the foreign titles are borrowed from CARUS and ENGELMANN, and those which have not been verified by actual reference may not prove to be literally correct.]

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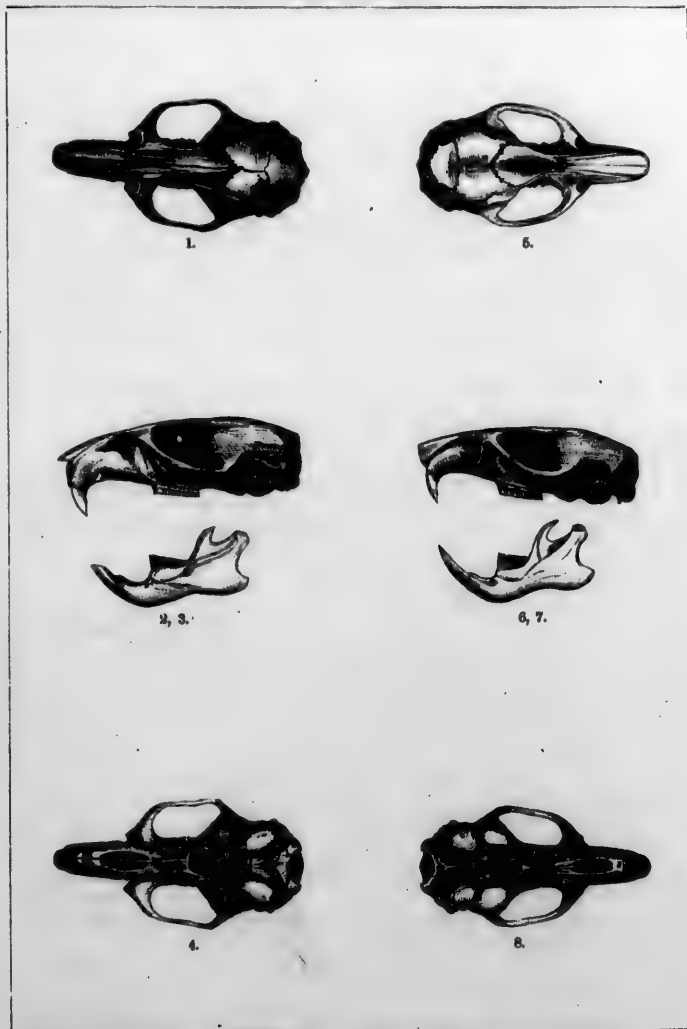
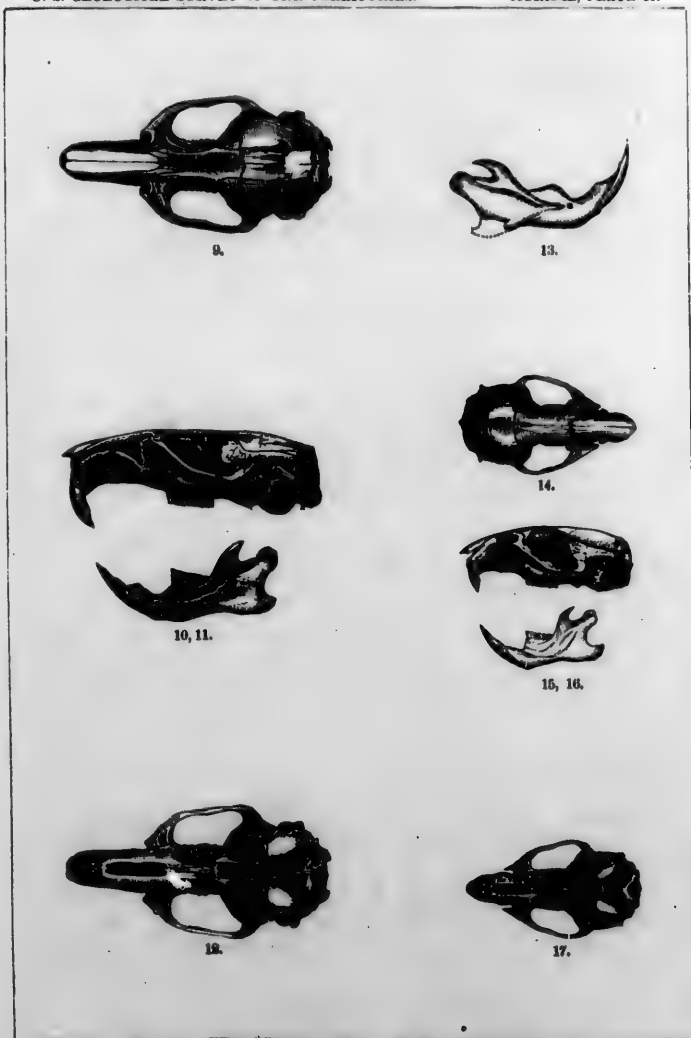
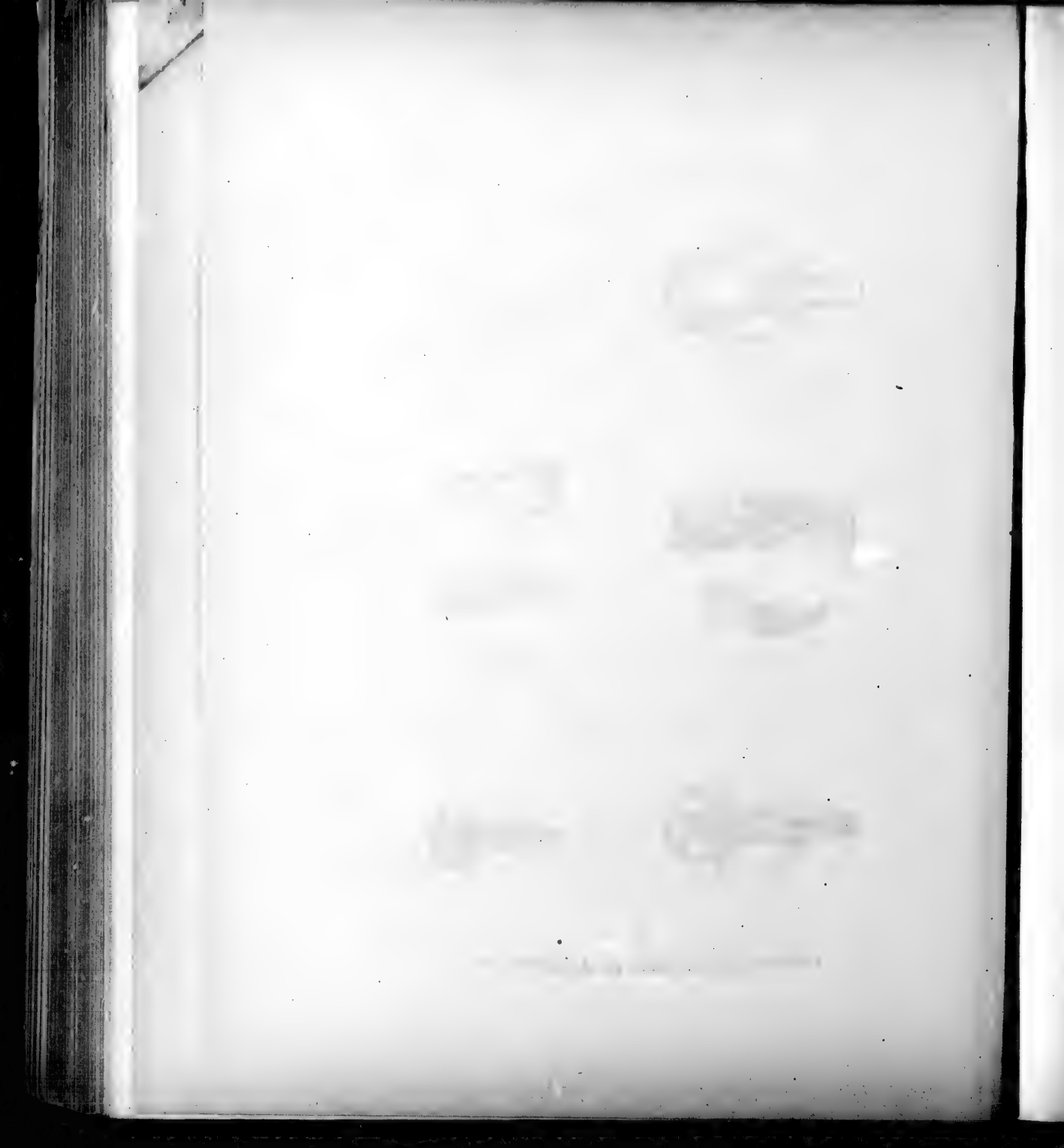


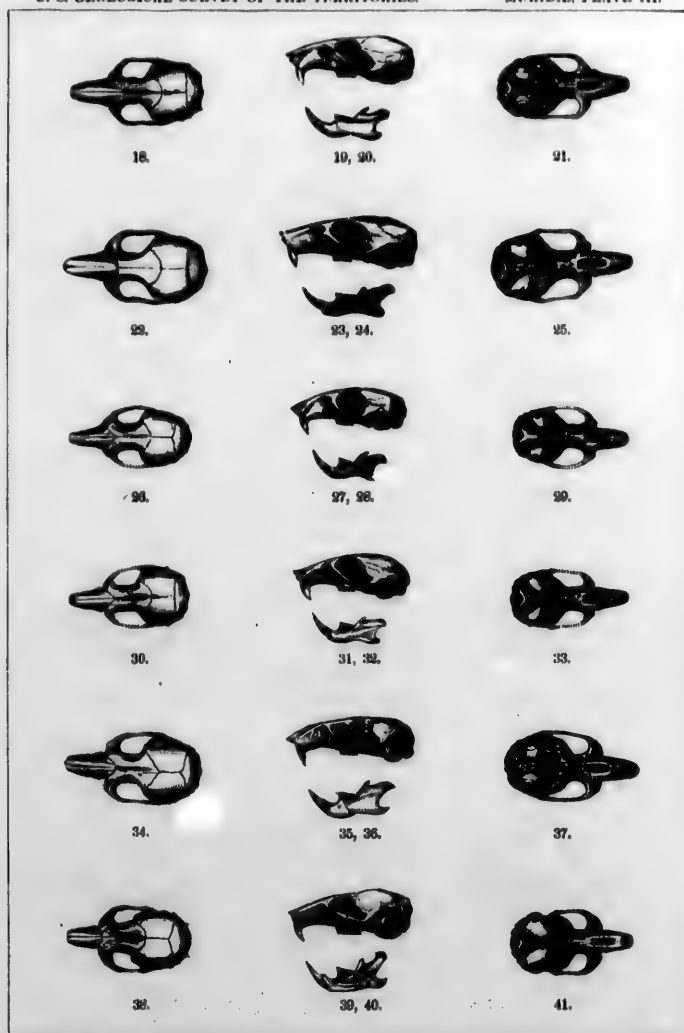
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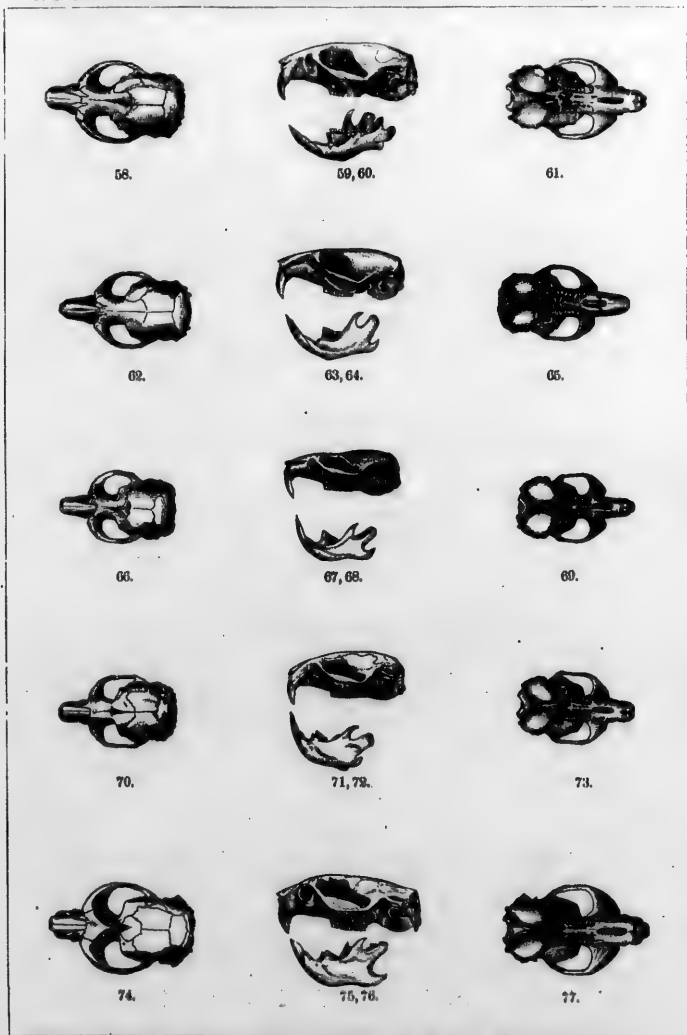
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MONOGRAPHS  
OF  
NORTH AMERICAN RODENTIA.

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No. II.—LEPORIDÆ.

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By J. A. ALLEN.

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## LETTER OF TRANSMITTAL.

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CAMBRIDGE, MASS., April 8, 1876.

SIR: I transmit herewith for publication my report on the North American *Leporidae*. As but two species of this family occur south of the United States that are not also found north of the United States and Mexican boundary, these have also been included, thereby rendering the present memoir a monograph of the *Leporidae* of the New World.

The material on which this report is based is primarily that of the National Museum, to which, through the kindness of the officers of the Smithsonian Institution, I have had the fullest access. This has been supplemented by that of the other principal collections of this country, by far the most important of which is that of the Museum of Comparative Zoölogy, Cambridge, Mass., of which also I have been permitted the freest use.

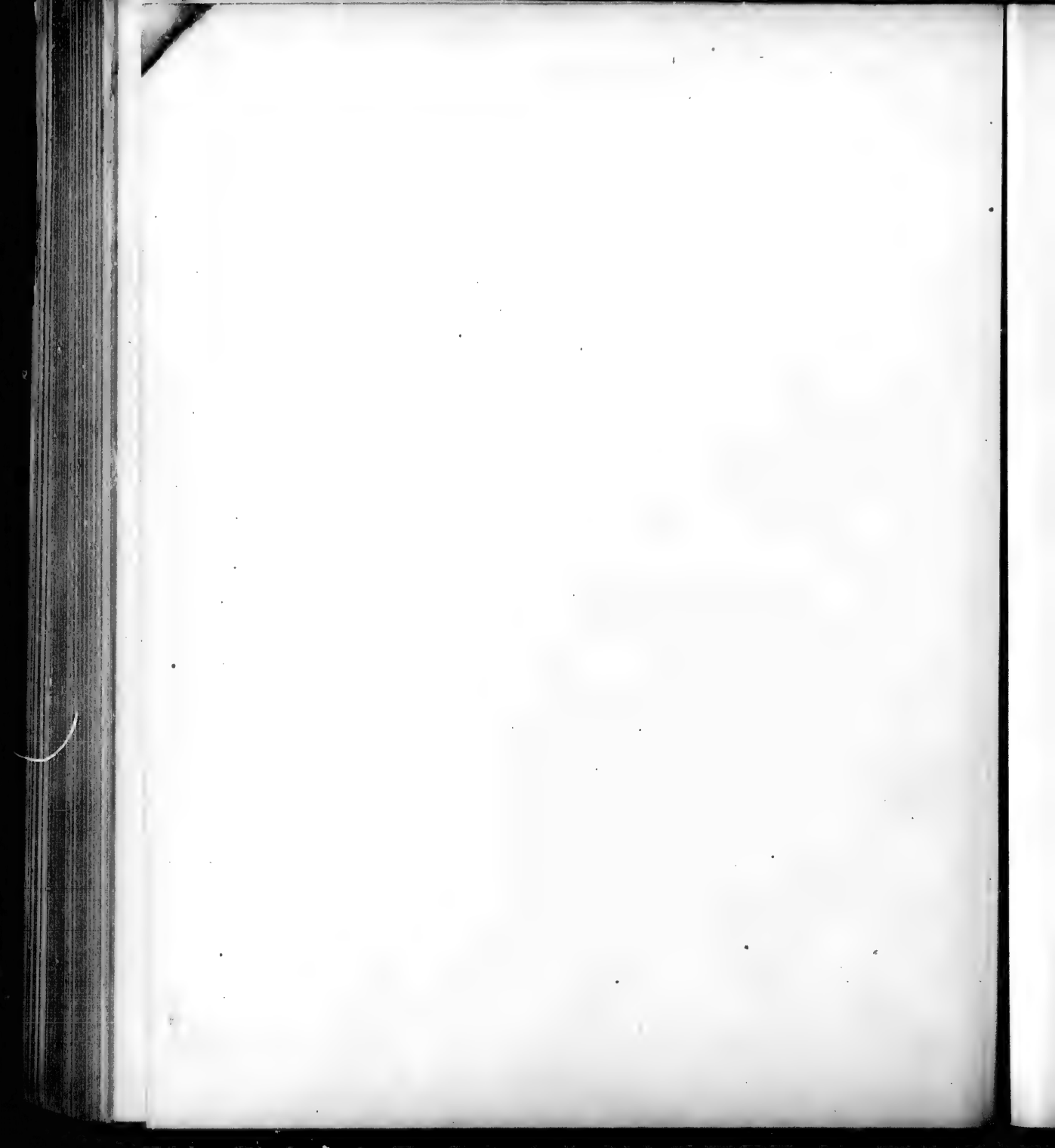
It gives me pleasure to mention in this connection that a large part of the material from the Trans-Mississippian portions of the United States has been gathered either personally by yourself or under your immediate direction and auspices.

I am, sir, very respectfully, yours,

J. A. ALLEN.

Dr F. V. HAYDEN,

*United States Geologist, etc., etc., Washington, D. C.*



## FAMILY LEPORIDÆ.

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The present revision of the American *Leporidae* is based upon the material contained in the National Museum at Washington, supplemented by that of the Museum of Comparative Zoölogy at Cambridge. The specimens in the Museum of the Academy of Natural Sciences of Philadelphia and in the Museum of the Boston Society of Natural History have also been examined. The author has thus had access not only to the types of the species described by Prof. S. F. Baird, in his great work on the Mammals of North America, published in 1857, but also to nearly all the material used by him in his excellent elaboration of this family in the above-named work, together with the vast amount of material that has since accumulated at the Smithsonian Institution. This includes not only the collections made by the different Government expeditions since 1857, but also the large collections made since that date, under the auspices of the Smithsonian Institution, in Alaska, the British Possessions, Mexico, and Central America. By far the larger portion of the specimens examined from localities within the United States received from any one source have been the collections made either by Dr. F. V. Hayden personally or under his immediate direction, and especially during the prosecution of the geographical and geological survey of the Territories, now in progress, under the auspices of the Department of the Interior. Large collections have also been received from the other Government surveys of the Territories made under the direction of the Topographical Bureau. The most important collections from the region north of the United States were made by the late Mr. Robert Kennicott and by Mr. William H. Dall, though very large additions have been received from



Mr. B. R. Ross, Mr. R. McFarlane, and other officers of the Hudson's Bay Company. The most important collections from localities south of the United States are those made by Prof. F. Sumichrast in Southeastern Mexico, by Mr. C. A. Schott in Yucatan, and by Prof. W. M. Gabb in Costa Rica.

As an indication of the amount of material that has been used in the preparation of the present memoir, it may be stated that of *Lepus americanus* (including its several varieties), the series of skulls alone numbers about one hundred and fifteen, which is supplemented by about the same number of skins; of *Lepus sylvaticus* and its varieties, the skulls number seventy, and the skins about one hundred and fifty, representing in each case, of course, a wide range of localities.

Among the results reached by the elaboration of this large amount of material is a better understanding of the character and amount of the variation dependent upon locality. These results, together with the data on which they are based, are presented with considerable detail in the following pages.

#### I.—GEOGRAPHICAL VARIATION.

Since most of the American *Leporidae* are not only mainly nocturnal in their habits—living concealed in shaded places, as under fallen trees, thick bushes, or even in burrows during the day—but also live mostly in swamps, thickets, or forests, they are in a measure shielded, it would seem, from the climatic influences that produce so marked an effect upon animals having different habits and affecting more exposed situations. Whether or not these conditions have a tendency to reduce the variation with locality due to climatic conditions to a minimum, or whether the species of this group are constitutionally less susceptible to climatic influences, we certainly find a less degree of geographical variation among the species of the *Leporidae* than among many other families of mammals. A considerable amount of variation, resulting from conditions of environment, however, exists among them, and conforms to the general laws of geographical variation previously announced as obtaining among both the mammals and birds of this continent.

Among the *Leporidae*, cases of melanism are of rare occurrence, less than half a dozen instances being as yet known to me among our native species. Albinism, in its true sense, seems almost equally rare, since the regular assumption of a white winter pelage by the northern species can hardly be regarded as true albinism. Generally speaking, too, the variation in intensity of color

with locality is often less strongly marked than in many other groups, even among the Rodents. Taking as an illustration of this point one of our widest-ranging species, the little Wood-Hare (*Lepus sylvaticus* and its several varieties), we find that specimens from the Carolinas, Georgia, and Florida are, in the average, not much darker than those from Southern New England, the difference being generally too small to give in itself a positive clue to the locality, as is so generally the case in birds, and often in other groups of mammals. Indeed, specimens from the Mexican provinces of Vera Cruz and Yucatan are in no way positively distinguishable from those obtained about Washington or in Massachusetts.

On comparing, however, specimens from the Atlantic coast with others from the arid interior of the continent, we find the differences in color resulting from the different climatic conditions of the two regions are strongly marked, through the greater pallor of those inhabiting the dry plains and semi-desert portions of the Great Central Plateau. The bleaching effect of an arid climate is quite marked in specimens living as far east as Eastern Nebraska, while the greatest degree of pallor is seen in those inhabiting the Great Colorado Desert. Again, specimens from that portion of the Pacific slope north of California—a region of heavy rain-fall and dense forests—present as dark or even a darker phase of coloration than those from the Atlantic States, just as proves to be the case in the wide-ranging species of the *Sciuridæ* and *Muridæ*.

The same regional phases of color-variation are also illustrated by the Northern Hare (*Lepus americanus* and its varieties), which ranges in a similar way across the whole breadth of the continent. The increase in intensity of color from the north southward is rather more decidedly marked than in *L. sylvaticus*, in both its summer and winter conditions of pelage. Summer specimens from New England and the Middle States are of a much stronger ferruginous tint than those obtained during the same season from the arctic regions. Winter specimens differ in the more northern having the white color of the surface so deeply invading the pelage as to wholly conceal the brown under-fur, while in those from the extreme southern limit of its range the white is a mere slight superficial wash, by which the brown under-fur—of a stronger tint also than in the northern specimens—is only partly concealed, the white winter livery being often but imperfectly acquired at southern localities where it is always assumed for a much shorter period.

The same thing is also well seen in the Arctic Hare (*Lepus timidus*), in comparing Newfoundland specimens with those from the arctic coast, or those of Ireland and the mountains of Central Europe with those of Scandinavia. The Northern Hare also presents a somewhat parallel variation to that seen in *L. sylvaticus* in passing from the Atlantic coast to the Rocky Mountain region. In even arctic specimens, there is always, in the winter pelage, a pale rufous zone underlying the white color of the surface, which in turn has still a plumbeous zone beneath it. In winter specimens from the Rocky Mountains, the white of the surface often extends to the very base of the fur, the rufous and plumbeous zones being both undeveloped. Passing still farther westward, we meet, in the Columbia River region, a phase in which the summer pelage is even more rufous than in specimens from the Atlantic coast under the same parallels. The difference between northern and southern specimens in summer livery consists not so much in the absolutely darker color of the southern examples as in the greater intensity of the rufous, while the form living in the middle elevated region of the continent differs from those of both the Atlantic and Pacific coasts in the almost entire suppression of the rufous tint that forms the prevailing hue in the others.

The only other species of this family having a very extended habitat are the *Lepus aquaticus*, which ranges from the Gulf States to Yucatan and Central America, and the *Lepus callotis*, found throughout the dry interior from Southern Wyoming and Nevada far down upon the Mexican plateau. In the former, the variations in color between specimens from the most extreme points of its range are almost inappreciable; while, in the latter, there is a considerable increase of rufous to the southward.

In respect to general size, the variation with locality is not more marked than is that of color; specimens from northern localities being generally not much larger than those from southern localities. I know, in fact, of no species of American mammals which so nearly form an exception to the almost universal law of a decrease in size with the decrease of the latitude under which they live as do some of the species of the *Leporidae*. Yet, in the majority of instances, the law is here also borne out. Taking the skull as the most convenient element on which to base a comparison, it is found (see Table I) that a series of specimens of *Lepus americanus* from New York, Pennsylvania, and Massachusetts averages *larger* even than another series from Norway, Me.; while the latter averages larger than another series

from Alaska and the northwestern portions of British America. This instance, however, forms the only actual exception to the general law of decrease in size southward. In all the other species, those from the more southern localities are the smaller. Thus, Georgia specimens of *Lepus sylvaticus* are appreciably smaller than those from about Washington; specimens of variety *Nuttalli* from Western Texas are smaller than those of the same variety from Deer Creek, Nebraska; specimens of *L. californicus* from Cape Saint Lucas are also considerably smaller than those from about San Francisco; and the same is true of specimens of *L. Trowbridgi* from these two localities.

TABLE I.—Measurements of skulls of American species and varieties of *LEPUS*, showing variation in size, with locality.

	Total length.	Greatest width.	Distance between orbits.	Nasal bones, length.	Nasal bones, width behind.	Nasal bones, width before.	Upper incisors from front to molars.	Upper incisors from front to hinder margin of palate.	Upper incisors, height.	Upper incisors, width between external edges.	Upper molars, length taken together.	Upper molars, distance between.	Lower jaw, length.	Lower jaw, height.	Locality.
Average size of 5 specimens of <i>Lepus californicus</i> .	1.79	1.72	0.80	1.56	0.83	0.79	1.80	1.55	0.34	0.33	0.69	0.51	3.50	1.47	Vicinity of San Francisco, Cal.
Average size of 10 specimens of <i>Lepus californicus</i> .	1.58	1.56	0.72	1.47	0.70	0.66	1.60	1.39	0.40	0.34	0.59	0.47	3.20	1.45	Cape Saint Lucas, Lower California.
Average size of 14 specimens of <i>Lepus americanus</i> .	1.67	1.53	0.83	1.80	0.85	0.84	0.96	1.25	0.34	0.27	0.58	0.47	3.14	1.45	Oxford County, Maine.
Average size of 6 specimens of <i>Lepus americanus</i> .	3.93	1.60	0.69	1.31	0.66	0.63	0.99	1.30	0.35	0.30	3.63	0.49	2.96	1.53	New York and Pennsylvania.
Average size of 96 specimens of <i>Lepus americanus</i> .	3.04	1.59	0.67	1.31	0.66	0.64	0.99	1.24	0.33	0.26	0.56	0.45	3.1	1.56	Alaska and British Possessions.
<i>Lepus sylvaticus</i> var. <i>sylvaticus</i> .	4.83	1.43	0.74	1.21	0.61	0.59	0.90	1.29	0.3	0.25	0.54	0.44	1.97	1.31	Washington, D. C.
Do .....	3.81	1.37	0.74	1.19	0.57	0.49	0.91	1.29	0.26	0.26	0.52	0.40	1.9	1.29	Saint Simon's Island, Georgia.
Average size of 4 specimens of <i>Lepus sylvaticus</i> var. <i>Nuttalli</i> .	3.72	1.40	0.69	1.17	0.59	0.50	0.90	1.16	0.34	0.23	0.50	0.37	1.8	1.32	Deer Creek, Nebr.
Average size of 7 specimens of <i>Lepus sylvaticus</i> var. <i>Nuttalli</i> .	3.56	1.27	0.60	1.07	0.59	0.49	0.81	1.10	0.26	0.22		0.36	1.7	1.24	Vicinity of Brownsville, Tex.
Average size of 4 specimens of <i>Lepus Trowbridgi</i> .	3.50	1.27	0.57	1.11	0.47	0.43	0.70	1.04	0.27	0.21	0.47	0.35	1.71	1.18	Vicinity of San Francisco, Cal.
Do .....	3.30	1.17	0.50	0.94	0.43	0.39	0.70	0.80	0.24	0.18	0.43	0.36	1.4	1.04	Cape Saint Lucas, Lower California.

While in the *Lepus sylvaticus* group, variety *sylvaticus* shades imperceptibly into variety *Nuttalli* in passing from the wooded region westward to the treeless plains, and while Iowa specimens of *sylvaticus* are the largest

received from any locality, we find that variety *Nuttalli* finally not only differs markedly in its paler color from variety *sylvaticus*, but also differs in being smaller; just as, in most cases among the mammals, the pallid forms of the arid plains and deserts prove to be also depauperate varieties of their brighter-colored and more favored or better-fed conspecific allies.

Geographical variations in the relative size of the feet and ears as compared with the general size is not so easily determined from skins as is the difference in general size based on the size of the skull; and the only point in this connection that will be specially noticed is the lengthening of the ears to the southward, manifested by nearly all the species, the ears, in many cases, actually increasing in length while the general size diminishes. There is also a marked tendency to an enlargement of the ears in proportion to the aridity of the habitat. Thus, in the *L. sylvaticus* group, variety *Nuttalli* has the ear generally quite appreciably larger than in variety *sylvaticus*, the maximum size of the ear being reached in the Great Colorado Desert in variety *arizonae*, which is chiefly distinguishable from its nearest allies, varieties *Nuttalli* and *Auduboni*, by the enlargement of this member. *L. callotis*, *L. californicus*, and *L. Troubridgei* also show a very perceptible increase in the size and length of the ear to the southward. In this connection, also, attention may be called to the fact that all of the long-eared species of American Hares are found exclusively over the most arid portions of the continent; just as, in the Old World, all of the longest-eared species are found in the arid portions of Asia and Africa.

The subject of geographical variation in size being quite fully discussed in connection with the detailed descriptions of the species and varieties given beyond, it is not necessary to devote further space to the subject here.

#### II.—INDIVIDUAL VARIATION.

The difference in size between specimens of the same age and sex from the same localities is often quite marked. The amount of this difference is sufficiently indicated by the subjoined measurements of skulls given in Table II. Care has been taken to select only fully adult specimens, and in the table only the maximum and minimum measurements are given.

TABLE II.—Measurements of skulls of the American species of *Lepus*, showing the range of individual variation in specimens from the same localities.

Number of specimens.	Species.	Total length.	Greatest width.	Distance between orbits.	Nasal bones, length.	Nasal bones, with behind.	Nasal bones, with before.	Upper incisors from front to hind margin of palate.	Upper incisors, height.	Upper incisors, width between external angles.	Upper molars, length taken together.	Upper molars, distance between.	Lower jaw, length.	Lower jaw, height.	Locality.	
5	<i>Lepus californicus</i> .....	Maximum..... Minimum.....	3.83 3.55	1.75 1.50	0.86 0.75	1.73 1.45	0.86 0.75	0.94 0.70	1.50 1.10	1.68 1.45	0.37 0.30	0.35 0.30	0.67 0.50	0.77 0.43	1.40 1.35	Vicinity of San Francisco, Cal.
10	.....do.....	Maximum..... Minimum.....	2.66 2.45	1.67 1.53	0.79 0.68	1.53 1.35	0.79 0.68	0.74 0.60	1.15 1.05	1.48 1.35	0.45 0.39	0.45 0.39	0.63 0.53	0.50 0.42	1.37 1.27	Cape Saint Lucas, Lower California.
14	<i>Lepus americanus</i> .....	Maximum..... Minimum.....	3.36 3.30	1.69 1.60	0.83 0.75	1.45 1.31	0.74 0.69	0.69 0.60	1.04 0.87	1.35 1.08	0.39 0.34	0.30 0.26	0.62 0.54	0.45 0.43	1.63 1.55	Oxford County, Maine.
36	.....do.....	Maximum..... Minimum.....	3.30 3.27	1.67 1.65	0.75 0.55	1.31 1.05	0.73 0.57	0.60 0.50	0.97 0.85	1.35 1.16	0.39 0.30	0.30 0.25	0.65 0.50	0.50 0.40	1.63 1.42	Different localities, Hudson's Bay Territory.
5	<i>Lepus sylvaticus</i> .....	Maximum..... Minimum.....	3.66 3.60	1.45 1.46	0.74 0.60	1.33 1.30	0.65 0.59	0.56 0.50	0.96 0.80	1.97 1.67	0.38 0.31	0.37 0.35	0.55 0.44	0.43 0.40	1.35 1.26	Georgia.
6	.....do.....	Maximum..... Minimum.....	3.60 3.50	1.56 1.55	0.85 0.65	1.05 0.90	0.43 0.35	0.46 0.40	0.80 0.75	1.07 0.94	0.31 0.25	0.35 0.47	0.33 0.30	0.44 0.41	1.17 1.02	Washington, D. C.
4	<i>Lepus sylvaticus</i> var. <i>Nuttall</i> .....	Maximum..... Minimum.....	3.80 3.67	1.45 1.37	0.70 0.67	1.06 1.00	0.53 0.50	0.43 0.35	0.85 0.85	1.15 1.30	0.30 0.25	0.30 0.25	0.47 0.37	0.33 0.30	1.02 0.89	Deer Creek, Nebraska.
7	.....do.....	Maximum..... Minimum.....	3.68 3.53	1.55 1.37	0.71 0.69	1.18 0.99	0.57 0.46	0.50 0.40	0.90 0.73	1.33 1.04	0.33 0.25	0.34 0.31	0.56 0.44	0.40 0.31	1.30 1.16	Vicinity of Matamoros, Texas.
4	<i>Lepus sylvaticus</i> var. <i>Townsendi</i> .....	Maximum..... Minimum.....	3.45 3.35	1.39 1.35	0.67 0.54	1.17 1.05	0.58 0.45	0.44 0.38	0.85 0.74	1.07 0.94	0.29 0.24	0.31 0.26	0.42 0.37	0.35 0.34	1.15 1.06	Vicinity of San Francisco, Cal.
4	.....do.....	Maximum..... Minimum.....	3.37 3.19	1.40 1.15	0.65 0.55	0.98 0.86	0.40 0.36	0.39 0.35	0.90 0.85	0.93 0.89	0.30 0.25	0.30 0.26	0.40 0.34	0.34 0.34	1.20 1.03	Cape San Lucas, Lower California.
12	<i>Lepus palustris</i> .....	Maximum..... Minimum.....	3.60 3.60	1.57 1.40	0.75 0.60	1.23 1.10	0.56 0.40	0.40 0.36	1.09 0.90	1.35 1.20	0.35 0.30	0.35 0.30	0.63 0.53	0.45 0.45	1.65 1.65	Saint Simon's Island, Georgia.
7	<i>Lepus campestris</i> .....	Maximum..... Minimum.....	3.65 3.65	1.70 1.60	0.83 0.65	1.23 1.05	0.60 0.47	0.58 0.50	1.19 1.05	1.53 1.36	0.47 0.43	0.50 0.45	0.70 0.56	0.50 0.45	1.75 1.56	Deer Creek, Nebraska.
5	<i>Lepus caninus</i> .....	Maximum..... Minimum.....	3.65 3.40	1.60 1.60	0.85 0.70	1.25 1.00	0.65 0.60	0.68 0.56	1.20 1.15	1.50 1.47	0.45 0.40	0.33 0.30	0.60 0.55	0.50 0.47	1.67 1.57	Upton, Oxford County, Maine.

Under the head of each species will be found detailed measurements of many specimens collected at identical localities, which further show the extent and character of the purely individual variations presented by the different species. These tables show that the variation is not confined to size, but affects the relative size of the different parts of the body and skull. Individual variation in the relative size of the ear, the feet, etc., to the general size is also, in many cases, quite noteworthy, as will be fully noticed in connection with the description of the species and varieties. The variation, both in general size and the relative size of different parts, generally ranges from 20 to upward of 30 per cent. of the average size, the difference between the extremes being generally somewhat in proportion to the extent of the series of examples compared.

### III.—GEOGRAPHICAL DISTRIBUTION.

The family *Leporidae* has representatives throughout the two American continents, but is by far the most numerous represented in the temperate parts of North America. A single species only (*Lepus timidus*) ranges to the arctic coast, and is also circumpolar in its distribution, being found also in the boreal parts of Asia and Europe. The American representatives of this species (forming variety *arcticus*) differ but slightly from their Old World conspecific allies. In America, this species ranges over Greenland, the Barren Grounds, Labrador, and portions of Newfoundland, to the southward its habitat meeting, or slightly overlapping, that of *L. americanus*. *L. americanus* extends from the Barren Grounds southward to about the isotherm 52° Fahrenheit. Throughout most of this vast region, it forms the sole representative of the family. To the southward, its habitat overlaps the ranges of *L. campestris* and *L. sylvaticus*. Toward the southern border of its habitat, it runs into three recognizable varieties, differing, in their extreme phases of development, mainly in slight but pretty constant differences of color, yet they pass into each other by almost imperceptible gradations. These varieties are *virginianus*, *Bairdii*, and *Washingtoni*. Variety *virginianus* ranges over Southern New England and the more elevated parts of the Middle States, southward to Virginia, and westward to Minnesota; variety *Bairdii* occupies the dry interior region of the northern portion of the Rocky Mountain plateau; while variety *Washingtoni* occurs throughout

the damp, heavily-wooded region of British Columbia and Washington and Oregon Territories.

In the interior, we meet next with *Lepus campestris*, which ranges over the treeless region from the Saskatchewan Plains southward to about the latitude of Middle Kansas, or mainly between the isotherms of  $36^{\circ}$  and  $56^{\circ}$ .

Each of the three above-named species becomes more or less white in winter, and they are the only species which thus change. The whiteness of the winter pelage extends to the very base of the fur in the more northern species, but generally affects only the more superficial portions in the others, the whiteness decreasing to the southward in the representatives of the *L. americanus* group (excepting var. *Bairdii*), till in the extreme southern portions of the habitat of this species the change occurs merely at the surface. In *L. campestris*, the change is still less complete, decreasing similarly in extent southward, till in the extreme southern portion of its range the change fails to be universal, and rarely extends throughout the pelage, being confined mainly to a limited portion of the dorsal aspect.

The habitat of *Lepus sylvaticus* (including its several varieties) extends from Southern New England on the Atlantic coast southward to Yucatan, its representatives nowhere presenting marked seasonal changes of color. Throughout this vast extent of latitude, it also preserves a remarkable constancy of characters. From the Atlantic coast westward (south of the isotherm of  $45^{\circ}$ ) to the eastern edge of the Great Plains, it is represented solely by variety *sylvaticus*. Here it passes by imperceptible stages into variety *Nuttalli* (= *artemisias* auct.), which ranges thence westward nearly or quite to the Pacific coast north of the State of California. To the southward of this boundary, it is replaced, on the Pacific slope, by its nearly related variety *Auduboni*, and over the Great Colorado Desert becomes modified into another closely-allied form, to which we have given the name var. *arizonæ*. Variety *Nuttalli* ranges southward from the isotherm of  $45^{\circ}$  to the plains of Western Texas and New Mexico, and even as far south as the arid Mexican plateau. Variety *arizonæ* seems confined to the limited region of the almost rainless deserts of Arizona and Southern California, or the so-called Sonoran district. Variety *Auduboni* occupies the Pacific slope from the northern boundary of California southward to Cape Saint Lucas, and in the interior seems to gradually pass into var. *arizonæ*.

The Sierra Nevada Mountains seem also to form a barrier to the east-



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ward extension of two other well-marked species, namely, *L. californicus* and *L. Trowbridgei*, whose ranges are almost identical with that of *L. sylvaticus* var. *Auduboni*.

In the interior we meet with still another species (*L. callotis*), whose range extends from about the latitude of Southern Wyoming southward over the arid interior far into the Republic of Mexico. In the United States, this species also finds the Sierra Nevada Mountains a barrier to its westward extension, they bounding its habitat in that direction. The southern representatives of this species also constitute a seemingly well-marked variety (*texianus*), differing mainly in possessing a stronger suffusion of rufous.

In the southeastern portions of the United States, we meet with two species, which are confined almost exclusively to the swampy lowlands. These are the *L. palustris*, which ranges throughout the swampy districts of the South Atlantic and Gulf coast to Yucatan, and the *L. aquaticus*, which has not as yet been reported as occurring to the eastward of Alabama, but which extends westward and southward throughout the wet lowlands of the Gulf coast to Yucatan and other parts of Southern Mexico. These species also extend northward over the lowlands of the Lower Mississippi, having been found as far north as Southern Ohio.

The Tres Marias Islands afford still another species (*L. Graysoni* sp. nov.)—possibly an insular form—whose nearest affines are the members of the *L. sylvaticus* section of the genus, though in some respects it is allied also to the Swamp-hares.

*Lepus brasiliensis* is the sole representative of the *Leporidae* thus far recognized as occurring in any part of South America, its range extending from Patagonia northward to the Central American States. It seems, however, to be nowhere abundant.

The temperate portions of the North American continent, or the United States, thus form the region where the family reaches its maximum development. All the species but three (one of which, *Lepus Graysoni*, is probably an insular form) are found within the territory of the United States, as are also, with a single exception, all of their varieties. The other two species are *Lepus arcticus* and *Lepus brasiliensis*—the one an arctic form, the other tropical, while the variety is the subarctic race of *L. americanus*. One species only (*L. sylvaticus*) is found over a large portion of the area east of the Mis-

issippi. Two (*L. sylvaticus* and *L. americanus*) occur in Southern New England, over large portions of the Middle States, and over the northern portion of the tier of States adjoining the Great Lakes and the contiguous portions of Canada. Two (*L. sylvaticus* and *L. palustris*) are found in the lower portions of the South Atlantic States, and three (*L. sylvaticus*, *L. palustris*, and *L. aquaticus*) over most of the lowlands of the Gulf States.

The great interior arid plateau is the most prolific in species, four being here found. Three of these (*L. sylvaticus* var. *Nuttalli*, *L. campestris*, and *L. callotis*) range over most of the region between the eastern edge of the Great Plains and the Pacific slope, and the fourth (*L. americanus* var. *Bairdi*) is met with throughout the wooded portions of the Rocky Mountains, southward, at least, to New Mexico. Three species (*L. sylvaticus* var. *Auduboni*, *L. californicus*, and *L. Trowbridgei*) are also found on the Pacific slope from Southern Oregon to the southern point of Lower California. Two species (*L. callotis* var. *texianus* and *L. sylvaticus* var. *Nuttalli*) range over the dry interior of Mexico, and three species (*L. sylvaticus* var. *sylvaticus*, *L. palustris*, and *L. aquaticus*) are found in Eastern and Southeastern Mexico. These species also probably extend to the northern portions of the Central American States, where they reach the habitat of *L. brasiliensis*, which becomes the sole representative of the family thence southward.

#### IV.—BIBLIOGRAPHICAL RESUMÉ.

The more important notices of the American *Leporidae* are those enumerated below. The synonymy of the species and varieties will be found more fully discussed later.

- 1766.—Linnaeus, Syst. Nat., 12th ed., i, pp. 77, 78. Two species are given, *Lepus timidus* and *L. brasiliensis*, the latter only as American.
- 1779.—Barrington, Phil. Trans., lxii, 11. "Hudson's Bay Quadruped", = *L. americanus* var. *americanus*.
- 1779.—Forster, Phil. Trans., lxii, 376. American Hare, = *L. americanus* var. *americanus*, with vague allusions to *L. sylvaticus*.
- 1777.—Erxleben, Syst. Reg. Anim., 325, 330. *L. timidus* and *L. americanus*. The latter is based on Kalm's Haase (Reise Nörd. Am., iii, 349), Barrington's "Hudson's Bay Quadruped" (Phil. Trans., lxii, 11), and Forster's "American Hare" (Phil. Trans., lxii, 376), and hence entirely on unquestionable references to the *L. americanus* of recent authors, or the Northern Varying Hare.
- 1778.—Pallas, Nov. sp. Gliræ, 30. Two strictly American species, —*Lepus hudsonius* (= *L. americanus*) and *L. tapeti* (= *brasiliensis*); also *L. variabilis*, = *L. timidus*.
- 1780.—Fabricius, Faun. Grœnl., p. 26. *Lepus timidus*, = *L. timidus* var. *arcticus*.
- 1781 and 1784.—Pennant, Hist. Quad., no. 243, and Arct. Zool., i, 96. American Hare = *L. americanus*, with vague allusions to *L. sylvaticus*. (These editions I have not seen.)
- 1784.—Schöpf, Der Naturforscher, 20. Stück; Halle, 1784. Der nord-amerikanische Haase. An excellent description of *L. sylvaticus*. (See Baird, Mam. N. Amer., pp. 590, 600.)

- 1788.—Gmelin, Syst. Nat., 160-164. *L. variabilis*, = *L. timidus*; *L. americanus*, = *L. americanus*, referring partly also to *L. sylvaticus*; *L. brasiliensis*.
- 1792.—Schreber, Säuget., ii, 881-902. *Lepus nanus*, = *L. sylvaticus* plus *L. americanus*; *L. variabilis*, = *L. timidus*; *L. variabilis*, = *L. timidus*; *L. tapeti*, = *L. brasiliensis*.
- 1793.—Pennant, Aret. Zool., 2d ed., 108-111. "Varying Hare", = *L. timidus*; "American Hare", = *L. americanus* plus *L. sylvaticus*. (The earlier editions I have not seen.)
- 1801.—Shaw, Gen. Zool., ii, 202. *L. americanus*, = *L. americanus*, primarily, but vaguely includes *L. sylvaticus* and other species; *L. brasiliensis*.
- 1806.—Lewis, Barton's Med. and Phys. Journ., ii, 159. *L. variabilis*, = *L. campestris*.
- 1819.—Leach, Ross's 1st Voyage, 8vo ed., ii, app., 151, 170. *L. arcticus* and *L. glacialis*, = *L. timidus* var. *arcticus*. (This edition I have been unable to consult.)
- 1819.—Sabine (E.), Ross's 1st Voyage, app., xlv. *Lepus* ———, = *L. timidus* var. *arcticus*.
- 1822.—Desmarest, Mam., ii, 354. *L. americanus*, = *L. sylvaticus*.
- 1823.—Sabine (J.), Franklin's Journ. to Polar Sea, 664. *L. glacialis*, = *L. timidus* var. *arcticus*; *L. americanus*, = *L. americanus* var. *americanus*.
- 1824.—Sabine (E.), Parry's 1st Voy., app., clxxxvii. *L. glacialis*, = *L. timidus* var. *arcticus*.
- 1825.—Richardson, Parry's 2d Voy., 321. *L. glacialis*, = *L. timidus* var. *arcticus*.
- 1825.—Harlan, Faun. Amer., 193-198. *L. americanus*, = *L. sylvaticus*; *L. glacialis*, = *L. timidus* var. *arcticus*; *L. virginianus*, = *L. americanus* var. *virginianus*.
- 1826.—Godman, Am. Nat. Hist., ii, 157-165. *L. americanus*, = *L. sylvaticus*; *L. glacialis*, = *L. timidus* var. *arcticus*; Varying Hare ? composed apparently of *L. americanus* and *L. campestris*.
- 1829.—Fischer, Syn. Mam., 373. *L. glacialis*, = *L. timidus* var. *arcticus*; *L. americanus*, = *L. sylvaticus*; *L. virginianus*, = *L. americanus* var. *virginianus*.
- 1829.—Richardson, Faun. Bor.-Am., 217-226. *L. americanus*; *L. glacialis*, = *L. timidus* var. *arcticus*; *L. virginianus*, = *L. campestris*.
- 1830.—Doughty, Cab. Nat. Hist., i, 217, pl. xix, *L. americanus*.
- 1830.—Wagler, Nat. Syst. Amphib., 25. *L. callotis* is here first described. *Ibid.*, Isis, 1831, 511.
- 1831.—Wagler, Isis, 1831, 511. *L. callotis*.
- 1833.—Bennett, Proc. Zool. Soc. Lond., 1833, 41. *L. nigricaudatus*, = *L. callotis*.
- 1835.—Ross (J. C.), Ross's 2d Voy., app., xv. *L. glacialis*, = *L. timidus* var. *arcticus*.
- 1836.—Richardson, Back's Arctic Land Exped., 496-497. *L. americanus* and *L. glacialis*, the latter = *L. timidus* var. *arcticus*.
- 1836.—Richardson, Sixth Rep. British Assoc., 150. "*L. mexicanus*, Licht." (a MS. name) adopted for *L. callotis*.
- 1836.—Gray, London's Mag. Nat. Hist., 1836, 586. A *Lepus longicaudatus* is based on a specimen supposed to have come from the Straits of Magellan, but which proved to be referable to *L. saxatilis*, an African species, the locality being erroneous.
- 1837.—Gray, Charlesworth's Mag. Nat. Hist., i, 586. *L. Douglasi* var. 1, = *L. aquaticus*; *L. Douglasi* var. 2, = *L. palustris*; *L. californicus*, = *L. californicus*, which is here first described.
- 1837.—Bachman, Journ. Acad. Nat. Sci. Phila., vii, 194, pls. xv, xvi. *Lepus palustris*, described here for the first time.
- 1837.—Bachman, *Ibid.*, pp. 282-361, and pls. xxi-xxii. *L. glacialis*, = *L. timidus* var. *arcticus*; *L. virginianus*, = *L. americanus*, primarily, but the synonymy includes references to *L. campestris*; *L. aquaticus*, here first described; *L. americanus*, = *L. sylvaticus*; *L. palustris*; *L. Nuttalli*, = *L. sylvaticus* var. *Nuttalli*,—based on an immature specimen of what has been currently known as *L. artemisia*; *L. campestris*, here first distinctively named, and recognized as the *L. virginianus* of Richardson.
- 1837.—Bachman, *Ibid.*, p. 403. His *L. virginianus* changed to *L. americanus*, and the name *L. sylvaticus* bestowed upon the *L. americanus* of his former paper. Here the *L. sylvaticus* receives its first distinctive name, it having previously borne the name *L. americanus* (the name given it by Desmarest), whenever distinguished from the true *L. americanus*, with which it was for a long time confounded.
- 1838.—Waterhouse, Proc. Zool. Soc. Lond., vi, 103. *L. Bachmani*, = *L. sylvaticus* var. *Nuttalli*.

- 1839.**—Bachman, Journ. Acad. Nat. Sci. Phila., viii, 75-101. *L. glacialis*, = *L. timidus* var. *arcticus*; *L. americanus*; *L. sylvaticus*; *L. aquaticus*; *L. palustris*; *L. Nuttalli*, = *L. sylvaticus* var. *Nuttalli*; *L. nigricaudatus*, = *L. callotis*; *L. californicus*; *L. Richardsoni*, = *L. californicus*, and afterward so recognized by Bachman; *L. Townsendi*, = *L. campestris*, and later so recognized by Bachman; *L. artemisia*, = *L. sylvaticus* var. *Nuttalli*;—thirteen nominal species, three of which (*L. Richardsoni*, *L. Townsendi*, and *L. artemisia*) are here first described.
- Bachman's above-noticed papers are classic, and mark an important era of progress in the history of the American *Leporida*. In these papers, *L. palustris*, *L. aquaticus*, *L. "Nuttalli"*, and *L. "artemisia"* are for the first time described; *L. campestris* and *L. sylvaticus* receive their first distinctive names; and the confusion previously existing between these species and *L. americanus* is first cleared up. Two nominal species (*L. Townsendi* and *L. Richardsoni*) are added, but are afterward rescinded.
- 1840.**—Emmons, Rep. Quad. Mass., 56-59. *L. americanus*, = *L. sylvaticus*; *L. virginianus*, = *L. americanus*.
- 1842.**—DeKay, N. York Fauna, Mam., 93-97. *L. nanus*, = *L. sylvaticus*; *L. americanus*. Also, as extralimital species, *L. glacialis*, = *L. timidus* var. *arcticus*; *L. aquaticus*; *L. palustris*; *L. campestris*; *L. longicaudatus*, = *L. saxatilis*, not American; *L. nigricaudatus*, = *L. callotis*; *L. californicus*; *L. Richardsoni*, = *L. californicus*; *L. Townsendi*, = *L. campestris*; *L. artemisia* and *L. Bachmani*, = *L. sylvaticus* var. *Nuttalli*. Fourteen nominal species, which include seven valid species and one or two valid varieties.
- 1842.**—Thompson, Hist. of Vermont, 42-48. *L. virginianus*, = *L. americanus*; *L. americanus*, = *L. sylvaticus*.
- 1844.**—Gray, Zool. Voy. Sulphur, 35, pl. xiv. *L. Bennettii*, = *L. californicus*.
- 1844.**—Wagner, Schreber's Säugth., suppl., iv, 101-117. *L. glacialis*, = *L. timidus* var. *arcticus*; *L. campestris*; *L. americanus*; *L. callotis*, with vars. *nigricaudatus* and *flavicularis*, the latter here first described; *L. longicaudatus*, = *L. saxatilis* (not American, though at this time so supposed); *L. californicus*; *L. Richardsoni*, = *L. californicus*; *L. Townsendi*, = *L. campestris*; *L. palustris*; *L. aquaticus*; *L. Nuttalli*, = *L. sylvaticus* var. *Nuttalli*; *L. brasiliensis*; *L. nanus*, = *L. sylvaticus*; *L. artemisia*, = *L. sylvaticus* var. *Nuttalli*. Fourteen nominal species and two varieties.
- 1845.**—Schinz, Syn. Mam., ii, 285-294. *L. glacialis*, = *L. timidus* var. *arcticus*; *L. Bachmani*, = *L. sylvaticus* var. *Nuttalli*; *L. borealis*, = *L. americanus* var. *virginianus*; *L. aquaticus*; *L. sylvaticus*; *L. palustris*; *L. nigricaudatus*, = *L. callotis*; *L. Nuttalli*, = *L. sylvaticus* var. *Nuttalli*; *L. campestris*; *L. longicaudatus*, hab. "Texas", = *L. saxatilis*, and not American; *L. californianus*, = *L. californicus*; *L. Bennettii*, = *L. californicus*; *L. Richardsoni*, = *L. californicus*; *L. Townsendi*, = *L. campestris*; *L. artemisia*, = *L. sylvaticus* var. *Nuttalli*; *L. magellanicus* (Is. Malouin) = *L. cuniculus*, feral; *L. brasiliensis*. An indiscriminate compilation of seventeen nominal species.
- 1846-1854.**—Audubon and Bachman, Quad. North Amer., i, 95, 93, 173, 249, 287; ii, 96, 272, 300; iii, 35, 53, 156, with figures. *L. Townsendi*, = *L. campestris*; *L. americanus*; *L. sylvaticus*; *L. glacialis* = *L. timidus* var. *arcticus*; *L. aquaticus*; *L. artemisia*, = *L. sylvaticus* var. *Nuttalli*; *L. callotis*; *L. Nuttalli* and *L. Bachmani*, = *L. sylvaticus* var. *Nuttalli*; *L. californicus*; *L. texianus* = *L. callotis* var. *texianus*. Twelve nominal species, representing eight valid species and two varieties.
- 1846.**—Waterhouse, Nat. Hist. Mam., ii, 101-145. *L. glacialis* = *L. timidus* var. *arcticus*; *L. americanus*; *L. aquaticus*; *L. sylvaticus*; *L. palustris*; *L. Nuttalli*, *L. Bachmani*, and *L. artemisia*, = *L. sylvaticus* var. *Nuttalli*; *L. campestris* (to which *L. Townsendi* is properly referred); *L. californicus* (to which *L. Richardsoni* and *L. Bennettii* are properly referred); "*L. cunicularius* Licht.", = *L. aquaticus*; *L. texianus*, = *L. callotis* var. *texianus*; *L. callotis* (to which *L. nigricaudatus*, *L. flavicularis*, and *L. mexicanus* are properly referred); *L. brasiliensis*. *L. longicaudatus* is for the first time formally eliminated as an American species. Total, thirteen nominal species, based on nine valid ones and two or three valid varieties.
- 1853.**—Woodhouse, Sitgreaves's Expedition down the Zuni and Colorado Rivers, 64, 55. Notes on *L. sylvaticus*, *L. "artemisia"*, and *L. callotis*.
- 1853.**—Giebel, Säugth., 449 and 450. *L. americanus*, *L. campestris*, *L. callotis*, and *L. brasiliensis* described.
- 1855.**—Baird, Proc. Acad. Nat. Sci. Phila., 1855, 333. *L. Washingtoni* (= *L. americanus* var. *Washingtoni*) and *L. Trowbridgei*, both here described for the first time.

- 1857.**—Baird, Mam. N. Amer., 579-617. *L. glacialis*, = *L. timidus* var. *arcticus*; *L. americanus*; *L. Washingtoni*, = *L. americanus* var. *Washingtoni*; *L. campestris*; *L. callotis*; *L. californicus*; *L. sylvaticus*, = *L. sylvaticus* var. *sylvaticus*; *L. artemisia* and *L. Bachmani*, = *L. sylvaticus* var. *Nuttalli*; *L. Auduboni* (here first described), = *L. sylvaticus* var. *Auduboni*; *L. Trowbridgei*; *L. aquaticus*; *L. palustris*. Thirteen species are here recognized, which in this monograph are regarded as representing eight valid species and four valid varieties, one name only (*L. Bachmani*) being here reduced to a synonym. *L. flavigularis* Wagner and *L. texianus* Waterhouse are doubtfully referred to *L. callotis*; *L. texianus* Audubon and Bachman is regarded as a species probably distinct from the *L. texianus* Waterhouse, but is mentioned as a species which his materials did not allow him "to discuss or describe". *L. Nuttalli* is doubtfully referred to *L. artemisia*. He states that he strongly suspects the specimen on which *L. Nuttalli* was based to be an immature example of *L. artemisia*, and points out the fact that, in case it proves to be so, the name *Nuttalli* must take precedence over *artemisia*. The *L. canicularius* of Lichtenstein (Waterhouse), based on Mexican specimens, he properly suggests may prove to be *L. aquaticus*, as is undoubtedly the case. No mention is made of the *L. longicaudatus* of former authors, which Waterhouse had previously shown was African, and not referable to any American species. The synonymy of the subject is judiciously and exhaustively treated, and in no case do any of the collocations seem to require changing. Furthermore, in this monographic essay, the species are for the first time subgenerically divided; no names are, however, affixed to his very natural subdivisions, which are very properly treated as merely sections rather than as groups of a technically subgeneric value. Baird's treatment of the subject forms as great an advance over our previous knowledge of the group as did Bachman's articles twenty years before, and marks a second grand epoch in the literature of the North American *Leporidae*. Finally, Baird's work thus far greatly surpasses in accuracy and thoroughness any treatment of the *Leporidae* of any part of the world.
- 1857.**—Newberry and Baird, Zool. of Lieut. Williamson's Rep. upon Expl. for a R. R. Route from the Sacramento Valley to the Columbia River (Pacific R. R. Expl. and Surveys, etc., vi, pt. iv, no. 2, pp. 62-66). Field-notes by Dr. Newberry; identifications by Professor Baird; synonymy and diagnoses from Baird's Gen. Rep. Mam. N. Amer. The species mentioned are *L. campestris*, *L. californicus*, *L. "artemisia"*, *L. "Auduboni"*, and *L. Trowbridgei*.
- 1859.**—Baird, Zool. U. S. and Mex. Bound. Survey, 45-48. *L. callotis* (described in detail), and *L. californicus*, *L. sylvaticus*, *L. artemisia*, and *L. Bachmani* (the two latter = *L. sylvaticus* var. *Nuttalli*) mentioned by name merely, with field-notes by the collectors.
- 1859.**—Kennerly, Zool. of Lieut. Whipple's Route, near the 35th Parallel (Pacific R. R. Expl. and Surveys, etc., x, pt. vi, no. 2, 16, 17). Field-notes by Dr. Kennerly, with diagnoses extracted from Professor Baird's Gen. Rep. Mam. N. Amer. The following species are mentioned:—*L. callotis*, *L. "artemisia"*, *L. "Auduboni"*, and *L. Trowbridgei*.
- 1860.**—Cooper, Zool. of Gov. Stevens's Route near the 47th and 49th Parallels (Pacific R. R. Reps. xii, pt. iii, no. 2, 87). Field-notes and measurements by Dr. Cooper, with diagnoses of the species from Baird's Gen. Rep. Mam. N. Amer. The species mentioned are *L. "Washingtoni"*, and *L. Trowbridgei*.
- 1860.**—Suckley, *Ibid.*, pp. 103-105. Field-notes by Dr. Suckley and diagnoses from Baird's Gen. Rep. Mam. N. Amer. The species enumerated are *L. "Washingtoni"*, *L. campestris*, *L. californicus*, "*? L. callotis*" (= *L. callotis*), and *L. "artemisia"*.
- 1860.**—Suckley and Gibbs, *Ibid.*, pp. 130-133. Chiefly field-notes on *L. "Washingtoni"*, *L. campestris*, "*? L. callotis*" (= *L. callotis*), *L. californicus*, and *L. artemisia*.
- 1861.**—Maximilian, Wieg. Arch., 1861, i, 142-145. Habits and distribution of *L. americanus*, *L. sylvaticus*, and *L. campestris*.
- 1861.**—Ross, Canad. Nat. and Geol., vi, 436. Notice of *L. americanus*.
- 1862.**—Hayden, Trans. Amer. Philos. Soc. Phila., xii, 148. Notes on *L. campestris*, *L. sylvaticus*, and *L. "artemisia"*.
- 1867.**—Coues, Amer. Nat., i, 531-536; Proc. Acad. Nat. Sci. Phila., 36. Habits and distribution of *L. callotis* and *L. "artemisia"* in Arizona.
- 1867.**—Gray, Ann. and Mag. Nat. Hist., 3d ser., xx, 221-225. Divides the genus *Lepus* into seven so-called genera, raising several of Baird's sections (see Mam. N. Amer., 574, 575) to generic rank. His seven genera are (1) *Hydrolagus* (= Baird's section F), (2) *Sylvilagus* (= Baird's section D), (3) *Eulagus*, (4) *Lepus* (= Baird's sections A and E), (5) *Tapeti*, (6) *Cuniculus* (= Baird's section C), and (7) *Caprolagus*. The American species recognized are as follows:—(1) *Hydrolagus aquaticus* (= *L. aquaticus*), to which he properly refers his *L. Douglasi* var. 1;

- (9) *Hydrolagus palustris* (= *L. palustris*), to which he properly refers his *L. Douglassi* var. 2; (3) *Sylvilagus nanus* (= *L. sylvaticus*); (4) *Sylvilagus Artemisia* and (5) *Sylvilagus Bachmanni* [sic] (4 and 5 = *L. sylvaticus* var. *Nuttalli*); (6) *Lepus arcticus* (= *L. timidus* var. *arcticus*); (7) *Lepus americanus*; (8) *Lepus Washingtoni* (= *L. americanus* var. *Washingtoni*); (9) *Lepus campestris*; (10) *Lepus callosus* [sic], including the synonymy usually referred to *L. callosus*; (11) *Lepus californicus* (properly including his own *L. Bennettii* with its other synonymy); (12) ? *L. longicaudatus*, "Magellan's Straits", although he previously refers "*L. longicaudatus* Gray" to *L. saxatilis* (?); (13) *Tapeti brasiliensis*. Under *Cuniculus fodiens* (= *Lepus cuniculus* Linn.), he properly places the "*L. magellanicus* Less.", based on feral specimens of this species from the Falkland Islands.
- 1868.—Abbott, Cook's Geol. of New Jersey, 750. *L. sylvaticus* in New Jersey.
- 1868.—Cooper, Amer. Nat., ii, 536. Notes on the habits and distribution of *L. Townsendi* (= *L. campestris*) and *L. "artemisia"*.
- 1868.—Brown, Proc. Zool. Soc. Lond., 1868, 351. Notes on *L. americanus*.
- 1869.—Allen, Proc. Bost. Soc. Nat. Hist., xiii, 194. *L. sylvaticus* in Iowa.
- 1869.—Allen, Bull. Mus. Comp. Zool., i, 239. *Sylvilagus nanus* (= *L. sylvaticus*) in Massachusetts.
- 1869.—Cooper, Amer. Nat., iii, 470. Distribution of *L. callosus* and *L. californicus* in the Colorado Valley.
- 1869.—Coues, Proc. Bost. Soc. Nat. Hist., xiii, 86. Biographical account of *L. palustris*.
- 1869.—Frantsius, Wieg. Arch., 1869, i, 296. *L. brasiliensis* in Costa Rica.
- 1869.—Hayden, Amer. Nat., iii, 115. *Lepus Bairdii* (= *L. americanus* var. *Bairdii*) described.
- 1869.—Welch, Proc. Zool. Soc. Lond., 1869, 228. Seasonal changes of color in *L. americanus*.
- 1871.—Allen, Bull. Mus. Comp. Zool., ii, 184. *L. sylvaticus* and *L. palustris* in Florida.
- 1872.—Gilpin, Proc. and Trans. Nov. Soc. Inst. Nat. Sci., iii, 46. Notice of *L. americanus*.
- 1872.—Hensel, Abhandl. d. phys. Klasse d. Königl. Akad. d. Wissensch. zu Berlin, 1872, 62. *L. brasiliensis* in Southern Brazil.
- 1873.—Linneum, Amer. Nat., 771. Distribution and habits of *L. aquaticus*.
- 1873.—Merriam, Hayden's U. S. Geol. Survey, 6th Ann. Rep., 668-668. "*L. callosus*?" (= *L. campestris*), collected at Ogden, Utah, and a biographical notice of *L. "Bairdii"*.
- 1874.—Allen, Bull. Essex Inst., vi, 59, 59, 61, 66. Notes on the distribution of *L. callosus*, *L. campestris*, *L. sylvaticus* var. "*artemisia*", and *L. americanus* var. *Bairdii*.
- 1875.—Allen, Proc. Bost. Soc. Nat. Hist., xvii, 430-430. A general synopsis of the American *Leporidae*, with an analysis of the species and varieties, based on the collections of the Smithsonian Institution and the Museum of Comparative Zoölogy. Three primary divisions of the genus *Lepus* are recognized, with two subordinate divisions under each. The specific and subspecific characters are briefly indicated, together with the principal synonymy and the geographical distribution of each variety. The species and varieties recognized are as follows:—(1) *L. timidus* var. *arcticus*; (2) *L. campestris*; (3) *L. americanus*, with varieties (a) *americanus*, (b) *virginianus*, (c) *Washingtoni*, (d) *Bairdii*; (4) *Lepus sylvaticus*, with varieties (a) *sylvaticus*, (b) *Nuttalli*, (c) *Auduboni*; (5) *L. Townsbridget*; (6) *L. brasiliensis*; (7) *L. callosus*; (8) *L. californicus*; (9) *L. palustris*. No really new form is here added, and only one of those given by Baird in 1857 (*L. Bachmanni*) is canceled. The two additions made to those given by Baird are the *L. Bairdii* described by Dr. Hayden in 1869, and a variety through the division of the *L. americanus* of Baird's work into two varieties. The chief difference between the results here reached and those given by Baird consists in the reduction of several of the formerly so-called species to subspecies, in consequence of the increased amount of material at command having shown them to be intergrading forms.

#### V.—CHARACTERISTICS OF THE FAMILY AND SYNOPSIS OF THE SPECIES AND VARIETIES.

Excluding the genus *Lagomys*, formerly associated with the Hares, but of late very properly regarded as the type of a distinct family, the *Leporidae* constitute one of the most natural and best-defined groups among mammals. The *Lagomyidae* are decidedly their nearest allies, but differ in important

external and osteological characters, though presenting many features of general resemblance. No subdivisions of the family can apparently be made having a higher than generic value, the species being, in fact, apparently all strictly congeneric.

The most obvious external distinguishing characters of the Hares are their lengthened hind limbs, their large, sometimes very large, ears, and short, sometimes rudimentary, bushy, erect tail; most of the species have a thick coat of very soft loose fur. The skull presents also distinguishing features, namely, the large, deep, flattened rami of the lower jaw; the perforated or reticulated condition of the facial surface of the maxilla; the large size of the orbits, in which the foramina are confluent; the large size of the anterior palatine foramina, and the reduction of the palate to a mere bridge between the premolars; the large size, in short, of all the openings of the skull; the possession of more than the usual number of teeth, including both molars and incisors. The dental formula is as follows:—

$$\text{I. } \frac{2-2}{1-1}; \text{C. } \frac{0-0}{0-0}; \text{P. } \frac{3-3}{2-2}; \text{M. } \frac{3-3}{3-3} = \frac{16}{12} = 28.$$

The molars are rootless. *Lagomys* shares with *Lepus* the possession of several of these cranial characters, but they are much less developed.

In respect to the general skeleton, besides the elongated hind legs and feet, the Hares have the acromion-process of the scapula provided with a spine (metacromion) directed posteriorly at right angles to the axis of the scapula. The vertebral processes are generally long and slender, the thoracic vertebræ being provided with "remarkably long, single, compressed, median hypapophyses", not usually present in the other *Rodentia*.

### GENUS LEPUS Linn.

*Lepus* LINN., Syst. Nat.

*Hydrolagus* GRAY, Ann. & Mag. Nat. Hist., 3d ser., xx, 221, 1867.

*Sylvilagus* GRAY, *ibid.*, 221.

*Eulagus* GRAY, *ibid.*, 222.

*Lepus* GRAY, *ibid.*, 222.

*Tapeti* GRAY, *ibid.*, 224.

*Cuniculus* GRAY (nec Wagler), *ibid.*, 225.

*Oryctolagus* LILLJEBORG, Fauna öfver Sverige och Norge, 417, 1873. Type *L. cuniculus* Linn.; hence = *Cuniculus* Gray.

The characters of the genus have been sufficiently indicated in the preceding description of the family.

*Analysis of the species and varieties.*

- I. Skull much arched above; breadth one half the length; postorbital processes distinct, not soldered with the skull; nasals of medium length, their length equal to about four-fifths of the width of the skull.
- A. Hind feet longer than the head. Size large. Postorbital processes divergent, not in contact with the skull posteriorly. Pelage white in winter.
- a. Size large. Nasals about as wide in front as behind.
1. Ears rather shorter than the head. Pelage dusky yellowish-gray in summer, pure white to the roots in winter. Tail short, black above in summer. Size very large ..... *timidus* var. *articus*.
  2. Ears much longer than the head. Pelage pale yellowish-gray in summer; in winter, white at the surface and base and reddish in the middle. Tail long, white on both surfaces. Size smaller ..... *campestris*.
- b. Size medium. Nasals considerably narrower in front than behind.
3. Ears about equal to the length of the head..... *americanus*.
    - 3a. Pelage in summer pale cinnamon-brown; in winter, white at the surface and plumbeous at base, with a *narrow* middle band of reddish-brown..... var. *americanus*.
    - 3b. Pelage in summer cinnamon-brown; in winter, white at the surface and plumbeous at base, with a *broad* middle band of reddish-brown, which shows through the white of the surface, the white being often a mere surface-wash. Fully as large, or rather larger, than var. *americanus*..... var. *virginianus*.
    - 3c. Pelage redder in summer and whiter in winter than in the last, and size smaller ..... var. *Washingtoni*.
    - 3d. Size of the last, with the pelage more dusky and with generally little or no rufous in summer, and in winter nearly or wholly pure white to the base, the middle reddish band being commonly almost obsolete ..... var. *Bairdii*.



- B. Hind feet not longer than the head. Size small. Postorbital processes convergent, frequently (in old specimens) in contact with the skull posteriorly, but only rarely ankylosed with it. Pelage never white.
4. Gray above, varied with black, and more or less tinged with light yellowish-brown; under parts white.....*sylvaticus*.
  - 4a. Above yellowish-brown, with a tinge of reddish, var. *sylvaticus*.
  - 4b. Paler, rather smaller, with slightly larger ears, and rather stouter lower jaw .....var. *Nuttalli*.
  - 4c. Color nearly as in var. *sylvaticus*; ears rather longer and more distinctly black-tipped.....var. *Auduboni*.
  - 4d. Like var. *Nuttalli*, but paler, and with considerably longer ears .....var. *arizona*.
  5. Smaller than *sylvaticus*, with the postorbital process scarcely touching the skull posteriorly. Colors generally more finely blended, and darker. Tail very short, almost rudimentary.....*Trowbridgei*.
  6. Above gray, varied with black and pale yellow. Size of *Trowbridgei*, with the colors and sparsely-clothed feet of *palustris*. Tail very short, yellowish-brown below.....*brasiliensis*.
  7. Size of *sylvaticus*, with the coloration much as in *brasiliensis*. Tail white below. Feet sparsely haired, as in *L. palustris*..*Graysoni*.
- II. Skull less convex above; breadth considerably less than half the length; length of nasals more than four-fifths the width of the skull. Ears and hind feet longer than the head. Postorbital processes convergent, touching the cranium behind. Pelage never white. Tail long, black above, this color extending forward on the rump.
- A. Lower jaw large, massive.
    8. Above pale yellowish-gray, varied with black; below white, more or less tinged with fulvous.....*callotis*.
    - 8a. Pale yellowish-gray above, varied with black; below white, tinged with fulvous.....var. *callotis*.
    - 8b. More suffused with pale rufous throughout, with rather longer ears.....var. *texensis*.
  - B. Lower jaw disproportionably small, relatively smaller than that of any other American species of *Lepus*.
    9. Somewhat smaller than *callotis*, and more rufous above...*californicus*.

III. Postorbital process ankylosed with the skull. Hind feet short. Pelago never white.

A. Width of the skull half of the length.

10. Size medium. Tail long.....*palustris*.

B. Width of the skull considerably less than half the length.

11. Size large. Tail short.....*aquaticus*.

TABLE III.—Showing the ratio of the width and other measurements of the skull to the length.

Number of specimens.	Species.	Greatest width.	Max. basen. length.	Max. basen. width behind.	Max. basen. width before.	Upper incisors from front to molars.	Upper incisors from front to hinder margin of palate.	Upper molars, length taken together.	Upper molars, distance between.	Lower jaw length.	Lower jaw height.	Locality.
7	<i>Lepus timidus</i> var. <i>arcticus</i>	0.56	0.43	0.29	0.29	0.33	0.44	0.19	0.19	0.73	0.50	Various localities.
6	<i>Lepus americanus</i> var. <i>americanus</i>	0.50	0.41	0.21	0.19	0.30	0.40	0.19	0.15	0.71	0.47	New York and Pennsylvania.
14	.....do.....	0.50	0.41	0.21	0.18	0.31	0.41	0.19	0.15	0.70	0.47	Oxford County, Maine.
20	.....do.....	0.50	0.40	0.20	0.18	0.33	0.41	0.19	0.15	0.70	0.47	British Possessions.
6	<i>Lepus americanus</i> var. <i>Washingtoni</i>	0.50	0.39	0.21	0.18	0.30	0.40	0.15	0.14	0.68	0.47	Washington Territory.
1	<i>Lepus timidus</i> .....	0.49	0.45	0.24	0.24	0.32	0.42	0.18	0.14	0.67	0.46	Bavaria.
1	<i>Lepus variabilis</i> .....	0.51	0.39	0.20	0.21	0.32	0.44	0.19	0.16	0.72	0.50	Sweden.
5	<i>Lepus cuniculus</i> .....	0.46	0.47	0.18	0.17	0.31	0.44	0.17	0.14	0.69	0.47	Upton, Oxford County, Maine (domestic).
9	<i>Lepus callosus</i> .....	0.45	0.45	0.21	0.20	0.32	0.42	0.17	0.14	0.73	0.47	Various localities.
17	<i>Lepus californicus</i> .....	0.47	0.41	0.21	0.18	0.32	0.41	0.17	0.14	0.68	0.38	California and Lower California.
5	.....do.....	0.46	0.41	0.22	0.20	0.32	0.41	0.16	0.14	0.68	0.39	Vicinity of San Francisco, Cal.
10	.....do.....	0.45	0.41	0.20	0.19	0.21	0.39	0.16	0.14	0.68	0.39	Cape San Lucas, Lower California.
15	<i>Lepus campestris</i> .....	0.50	0.40	0.24	0.23	0.33	0.42	0.19	0.15	0.68	0.49	Various localities.
20	<i>Lepus sylvaticus</i> var. <i>sylvaticus</i>	0.50	0.43	0.21	0.17	0.32	0.43	0.19	0.15	0.69	0.46	.....do.
8	.....do.....	0.50	0.43	0.22	0.18	0.32	0.43	0.19	0.16	0.69	0.46	Washington, D. C.
5	.....do.....	0.49	0.42	0.21	0.17	0.32	0.43	0.16	0.15	0.69	0.46	Georgia.
15	<i>Lepus sylvaticus</i> var. <i>arizonae</i>	0.50	0.43	0.20	0.18	0.33	0.43	0.19	0.14	0.72	0.49	Various localities.
7	.....do.....	0.50	0.43	0.20	0.18	0.32	0.43	0.16	0.14	0.70	0.49	Texas.
4	.....do.....	0.51	0.43	0.20	0.18	0.33	0.42	0.16	0.14	0.70	0.49	Deer Creek, Nebraska.
10	<i>Lepus Trowbridgii</i>	0.50	0.43	0.19	0.18	0.31	0.40	0.16	0.14	0.69	0.45	Various localities.
4	.....do.....	0.51	0.44	0.19	0.17	0.32	0.42	0.16	0.14	0.69	0.45	Vicinity of San Francisco, Cal.
4	.....do.....	0.51	0.41	0.19	0.17	0.31	0.39	0.16	0.16	0.65	0.45	Cape San Lucas, Lower California.
13	<i>Lepus palustris</i> .....	0.51	0.40	0.18	0.20	0.31	0.42	0.20	0.15	0.74	0.50	Saint Simon's Island, Georgia.
5	<i>Lepus aquaticus</i> .....	0.46	0.42	0.19	0.18	0.32	0.44	0.19	0.15	0.72	0.48	Louisiana and Mississippi.

TABLE IV.—Measurements of skulls of the American species of *Lepus*, prepared in part with reference to showing geographical and individual variation in size.

Number of specimens.	Species.	Total length.	Greatest width.	Distance between orbits.	Nasal bones, length.	Nasal bones, width behind.	Nasal bones, width before.	Upper incisors from front to molars.	Upper incisors from front to blade margin of palate.	Upper incisors, height.	Upper incisors, with between external edge.	Upper molars, length taken together.	Upper molars, distance between.	Lower jaw, length.	Lower jaw, height.	Remarks.
7	<i>Lepus timidus</i> var. <i>arcticus</i> .....	Maximum..... Minimum..... Average.....	4.05 3.55 3.70	2.08 1.75 1.91	1.60 1.45 1.63	0.86 0.75 0.83	0.86 0.75 0.83	0.89 0.75 0.83	1.38 1.18 1.28	1.06 0.96 1.01	0.37 0.33 0.35	0.75 0.70 0.73	0.63 0.57 0.60	2.05 2.50 2.25	2.05 1.65 1.85	
26	<i>Lepus americanus</i> var. <i>americanus</i> .....	Maximum..... Minimum..... Average.....	3.30 2.87 3.04	1.67 1.45 1.53	1.31 1.05 1.18	0.73 0.55 0.67	0.73 0.55 0.67	0.69 0.50 0.59	0.97 0.85 0.91	0.36 0.30 0.33	0.30 0.24 0.26	0.63 0.53 0.58	0.50 0.40 0.45	2.30 1.95 2.15	1.63 1.42 1.58	Alaska and British Possessions.
14	<i>Lepus americanus</i> var. <i>virginianus</i> .....	Maximum..... Minimum..... Average.....	3.30 2.80 3.07	1.63 1.40 1.55	1.45 1.16 1.31	0.74 0.56 0.65	0.74 0.56 0.65	0.63 0.50 0.57	0.94 0.87 0.90	0.34 0.28 0.31	0.26 0.20 0.23	0.54 0.40 0.47	0.45 0.35 0.40	2.45 2.05 2.25	1.63 1.25 1.45	Upton, Oxford County, Maine.
6	<i>do</i> .....	Maximum..... Minimum..... Average.....	3.35 3.10 3.23	1.64 1.53 1.60	1.40 1.23 1.31	0.76 0.63 0.69	0.76 0.63 0.69	0.70 0.54 0.63	1.00 0.89 0.95	0.35 0.29 0.32	0.40 0.35 0.38	0.57 0.49 0.53	0.47 0.38 0.43	2.50 2.35 2.43	1.47 1.35 1.40	Eastern States.
6	<i>Lepus americanus</i> var. <i>Washingtoni</i> .....	Maximum..... Minimum..... Average.....	3.10 2.80 2.95	1.50 1.40 1.45	1.17 1.00 1.08	0.56 0.46 0.51	0.56 0.46 0.51	0.50 0.40 0.45	0.81 0.68 0.75	0.25 0.20 0.23	0.25 0.20 0.23	0.50 0.40 0.45	0.40 0.35 0.38	1.98 1.86 1.92	1.97 1.86 1.92	Various localities.
15	<i>Lepus campestris</i> .....	Maximum..... Minimum..... Average.....	3.51 3.00 3.25	1.76 1.53 1.65	1.47 1.30 1.38	0.84 0.67 0.75	0.84 0.67 0.75	0.81 0.66 0.73	1.14 0.95 1.05	0.45 0.38 0.41	0.36 0.30 0.33	0.54 0.47 0.51	0.54 0.47 0.51	2.77 2.60 2.68	1.72 1.60 1.66	<i>do</i> .....
17	<i>Lepus californicus</i> .....	Maximum..... Minimum..... Average.....	3.56 3.00 3.28	1.83 1.75 1.79	1.46 1.35 1.40	0.76 0.60 0.68	0.76 0.60 0.68	0.64 0.53 0.58	1.00 0.89 0.95	0.36 0.29 0.33	0.34 0.28 0.31	0.60 0.49 0.54	0.48 0.41 0.45	2.77 2.60 2.68	1.47 1.37 1.42	Various localities.
5	<i>do</i> .....	Maximum..... Minimum..... Average.....	3.79 3.45 3.62	1.78 1.53 1.65	1.45 1.28 1.37	0.75 0.60 0.68	0.75 0.60 0.68	0.70 0.58 0.64	1.10 0.95 1.03	0.39 0.33 0.36	0.30 0.25 0.28	0.56 0.49 0.53	0.50 0.45 0.48	2.43 2.35 2.39	1.65 1.57 1.61	Vicinity of San Francisco, Cal.
10	<i>do</i> .....	Maximum..... Minimum..... Average.....	3.60 3.45 3.52	1.67 1.53 1.58	1.33 1.28 1.31	0.73 0.60 0.67	0.73 0.60 0.67	0.74 0.60 0.67	1.15 1.00 1.08	0.34 0.28 0.31	0.33 0.28 0.31	0.62 0.50 0.56	0.51 0.43 0.48	2.50 2.37 2.44	1.47 1.37 1.42	Cape San Lucas, Lower California.
9	<i>Lepus callosus</i> .....	Maximum..... Minimum..... Average.....	4.08 3.27 3.65	1.88 1.63 1.74	1.46 1.28 1.37	0.94 0.80 0.87	0.94 0.80 0.87	0.86 0.70 0.78	1.00 0.87 0.94	0.34 0.28 0.31	0.30 0.25 0.28	0.59 0.47 0.53	0.50 0.40 0.45	2.50 2.50 2.50	1.60 1.60 1.60	Various localities.

15	<i>Lepus sylvaticus</i> var. <i>cyathicus</i> .....	2.19	1.59	0.99	1.49	0.99	0.54	1.00	1.34	0.39	0.39	0.69	0.47	0.15	1.47	Various localities.
	Maximum.....	2.35	1.83	0.93	1.60	0.99	0.40	0.75	1.07	0.96	0.53	0.47	0.25	1.70	1.17	
	Minimum.....	2.01	1.46	0.71	1.21	0.56	0.40	0.90	1.21	0.55	0.55	0.55	0.45	1.23	1.20	
	Average.....	2.06	1.46	0.69	1.28	0.65	0.50	0.80	1.21	0.55	0.55	0.55	0.44	1.30	1.20	
	Maximum.....	2.06	1.35	0.65	1.05	0.50	0.45	0.75	1.07	0.54	0.55	0.47	0.25	1.21	1.17	Washington, D. C.
	Average.....	2.03	1.43	0.74	1.21	0.61	0.50	0.80	1.53	0.50	0.55	0.54	0.44	1.27	1.21	Georgia.
	Minimum.....	2.07	1.45	0.74	1.23	0.63	0.50	0.86	1.27	0.58	0.57	0.56	0.45	1.29	1.23	
	Maximum.....	2.06	1.58	0.63	1.10	0.54	0.40	0.66	1.17	0.51	0.55	0.50	0.48	1.09	1.20	
	Average.....	2.01	1.37	0.74	1.29	0.61	0.50	0.80	1.53	0.50	0.55	0.54	0.44	1.27	1.21	Various localities.
	Maximum.....	2.09	1.45	0.70	1.30	0.55	0.56	0.93	1.30	0.57	0.57	0.58	0.48	1.27	1.40	
	Minimum.....	2.43	1.95	0.63	0.96	0.49	0.40	0.73	1.14	0.55	0.51	0.44	0.31	1.70	1.17	Various localities.
	Average.....	2.08	1.31	0.68	1.13	0.52	0.47	0.65	1.13	0.56	0.54	0.49	0.35	1.58	1.38	
	Maximum.....	2.06	1.35	0.71	1.15	0.55	0.50	0.90	1.18	0.53	0.54	0.58	0.40	1.50	1.30	Western Texas.
	Minimum.....	2.43	1.95	0.63	0.96	0.49	0.40	0.73	1.04	0.55	0.51	0.44	0.31	1.70	1.17	
	Average.....	2.56	1.99	0.65	1.07	0.58	0.45	0.81	1.10	0.56	0.54	0.49	0.38	1.78	1.34	
	Maximum.....	2.60	1.45	0.70	1.26	0.53	0.50	0.93	1.17	0.57	0.56	0.50	0.38	1.68	1.40	Deer Creek, Nebraska.
	Minimum.....	2.67	1.37	0.67	1.10	0.50	0.50	0.95	1.15	0.50	0.55	0.47	0.37	1.53	1.33	
	Average.....	2.75	1.40	0.69	1.16	0.53	0.50	0.90	1.16	0.54	0.55	0.50	0.37	1.56	1.35	Various localities.
	Maximum.....	2.55	1.38	0.67	1.17	0.53	0.44	0.85	1.07	0.50	0.53	0.48	0.37	1.73	1.15	
	Minimum.....	2.18	1.15	0.54	0.90	0.40	0.38	0.65	0.93	0.53	0.53	0.40	0.34	1.43	1.03	
	Average.....	2.45	1.38	0.67	1.05	0.46	0.40	0.75	0.80	0.55	0.50	0.44	0.35	1.60	1.05	Vicinity of San Francisco, Cal.
	Maximum.....	2.55	1.38	0.67	1.17	0.53	0.44	0.85	1.07	0.50	0.53	0.48	0.34	1.70	1.08	
	Minimum.....	2.45	1.25	0.54	1.05	0.48	0.38	0.75	1.00	0.54	0.51	0.47	0.35	1.71	1.13	Cape San Lucas, Lower California.
	Average.....	2.59	1.39	0.65	1.11	0.47	0.40	0.74	0.93	0.56	0.50	0.45	0.37	1.58	1.05	
	Maximum.....	2.57	1.39	0.65	0.90	0.45	0.40	0.74	0.93	0.56	0.50	0.45	0.37	1.58	1.05	
	Minimum.....	2.18	1.15	0.55	0.90	0.40	0.38	0.65	0.93	0.53	0.53	0.40	0.34	1.43	1.03	Saint Simon's Island, Georgia.
	Average.....	2.39	1.17	0.59	0.94	0.43	0.38	0.70	0.99	0.54	0.51	0.48	0.36	1.49	1.04	
	Maximum.....	2.59	1.37	0.75	1.33	0.56	0.40	1.00	1.35	0.55	0.50	0.45	0.35	2.00	1.50	Louisiana and Mississippi.
	Minimum.....	2.00	1.40	0.63	1.15	0.46	0.50	0.92	1.53	0.56	0.54	0.57	0.40	2.50	1.50	
	Average.....	2.67	1.51	0.71	1.34	0.54	0.68	0.97	1.59	0.58	0.58	0.60	0.45	2.50	1.73	
	Maximum.....	2.46	1.62	0.63	1.50	0.67	0.68	1.18	1.53	0.40	0.55	0.67	0.54	2.50	1.50	
	Minimum.....	2.30	1.45	0.70	1.30	0.56	0.54	1.06	1.43	0.53	0.59	0.60	0.50	2.50	1.50	
	Average.....	2.40	1.55	0.73	1.45	0.64	0.61	1.06	1.49	0.56	0.51	0.63	0.59	2.45	1.64	

## LEPUS TIMIDUS Linn.

## Polar Hare.

## Var. TIMIDUS.

- Lepus timidus* LINN., Syst. Nat., 10th ed., i, 1758, 57; 12th ed., 1760, —; Faun. Suec., 2d ed., 1761, 9. — *Nec* *L. timidus* GMELIN, Syst. Nat., 1788, i, 160, and most subsequent authors, which is *L. europæus* PALLAS, Nov. Sp. Glires, 1778, 30. — ERKLEBEN, Syst. Reg. Anim., 1777, 329. — THUNBERG, Beskr. på Svenske Djur., 1798, 38. — RETZIUS, Faun. Suec., i, 1800, 31. — LILLJEBORG, Kongl. Vetensk. Akad. i Stöckh. Handl., 1850 [1851], 26; Fauna öfver Sverige och Norges Rygggradsdjur, 1873, 418. — HOLMGREN, Skandin. Digg., 1865, 280.<sup>7</sup>
- Lepus timidus* var. *β*. JENYNS, Brit. Vert. An., 1835, 35.
- Lepus variabilis* PALLAS, Nov. Sp. Glires, 1778, i, 30; Zoog. Rosso-Asiat., i, 1811, 145. — ZIMMERMANN, Geog. Gesch., ii, 1790, 235. — GMELIN, Syst. Nat., i, 1788, 161. — SCHREBER, Säuget., iv, 1793, 885, pl. cccxxv, A, B. — SHAW, Gen. Zool., ii, 1801, 201. — DESMAREST, Mammal., 1800, 349. — FLEMING, Brit. An., 1828, 33. — FISCHER, Syn. Mam., 1829, 373. — NILSSON, Skand. Faun., 1832, 22. — KEYSERLING & BLASIUS, Wirbelth. Europa's, 1840, 31. — WAGNER, Schreber's Säuget., suppl., iv, 1844, 79. — BELL, Brit. Quad., 1847, 343. — WATERHOUSE, Nat. Hist. Mam., ii, 1848, 51. — MIDDENDORF, Bull. Acad. Pétersb., ix, 1851, 236. — GIEBEL, Säuget., 1855, 446. — SCHRENCK, Reisen in Amurland, 1858.
- Lepus albus* BRISSON, Reg. An., 1760, 139. — JENYNS, Brit. Vert. Anim., 1835, 35.
- Lepus borealis* NILSSON, Vet. Akad. Öfvers., 1847, 133; Skand. Faun., 1847, 440.
- Lepus canescens* NILSSON, Vet. Akad. Öfvers., 1847, 133; Skand. Faun., 1847, 429.
- Lepus hibernicus* BELL, Brit. Quad., 1837, 341. — THOMPSON, Trans. Roy. Irish Acad., xviii, iii, 1838, —.

## Var. ARCTICUS.

- Lepus timidus* FABRICIUS, Faun. Grænl., 25, 1750.
- Lepus arcticus* LEACH, Ross's Voyage, 8vo. ed. ii, 1819, app., 151. — GRAY, Ann. and Mag. Nat. Hist., 3d ser., xx, 1837, 234.
- Lepus glacialis* LEACH, Ross's Voyage, 8vo. ed. ii, 1819, app., iv, 170. — SABINE, Nat. Franklin's Journey, 1823, app., 664; Parry's First Voyage, suppl., 1824, 187. — RICHARDSON, Parry's Second Voyage, 1825, app., 337; Faun. Bor.-Am., i, 1829, 321; Back's Arct. Land Exped., 1836, app., 497. — HARLAN, Faun. Am., 1825, 194. — GODMAN, Am. Nat. Hist., ii, 1895, 162. — H. SMITH, Griffith's Cuvier's An. King., v, 1827, 265. — FISCHER, Synop. Mam., 1829, 373. — J. C. ROSS, Ross's Second Voyage, 1825, app., xv; Ross's Third Voyage, 1826, app., 83. — BACHMAN, Journ. Acad. Nat. Sci. Phila., vii, 1837, 285, pl. xxi; viii, 1838, 76. — WAGNER, Schreber's Säuget., iv, pl. cccxxv, D; Suppl. Schreber's Säuget., iv, 1844, 101. — WATERHOUSE, Nat. Hist. Mam., ii, 1848, 102. — AUD. & BACH., Quad. N. Am., i, 1849, 242, pl. xxxii. — BAIRD, Mam. N. Am., 1857, 577, pl. lvi, fig. 1 (skull). — MURRAY, Geog. Distr. Mam., 1866, 263. — BROWN, Proc. Zool. Soc. Lond., 1868, 351.

*Winter pelage* pure white, except the tips of the ears, which are black. The whiteness extends to the base of the fur. *Summer pelage* above light yellow-brownish gray, varied with black; below white, washed with plumbeous, darkest on the breast. Ears black, varied with yellowish-gray at the base, and bordered posteriorly with white. Rump and upper surface of the tail sooty-plumbeous. Under fur whitish at base, succeeded by a faint tinge of fulvous. Hairs black, with a subterminal broad bar of yellowish-gray, and tipped with black. Ears rather shorter than the head; hind feet much longer than the head. Length, 22 to 26 inches; hind foot, 6 inches; ear, 4 inches; weight, 7 to 11 pounds.

I am unable to find any characters, either in the skulls or skins, by which *L. "glacialis"* auct. can be distinguished from the *L. "variabilis"* auct. (= *L. timidus* Linn., 1766), and I find that a similar difficulty has been encountered by other authors. Brown says, "It is difficult (indeed almost impossible) to give characters whereby this species can be separated from the *Lepus variabilis* of Europe when the former is in its summer dress; and the skull presents equal difficulties. I have, however, preferred to look upon it as nominally distinct, though I really believe that it is only a climatic variety of *L. variabilis*, Pallas."\* Lilljeborg also quotes Blasius as finding no difference of importance between *L. "glacialis"* and *L. variabilis*, either in skins or skulls.†

The earlier writers considered them identical, and in their accounts of *L. variabilis* usually spoke of it as inhabiting Greenland and the arctic portions of America as well as the northern parts of Europe and Asia.

The American animal was first regarded as specifically distinct from the European by Dr. Leach, in 1819, when he distinguished the American form first as *L. arcticus*, and later in the same work as *L. glacialis*. His specimens were from the shores of Baffin's Bay. In 1824, Captain Sabine (Appendix to Captain Parry's First Voyage) gave a detailed enumeration of its supposed distinctive characters, he believing the American form to be the larger, with proportionally longer ears, and the incisors more curved than in the European. These alleged differences, however, are such as disappear in the comparison of large series of each, being either simply individual peculiarities or differences due to the latitude of the locality. In accordance with the well established law of variation in size with locality (viz., decrease in size with decrease of latitude), specimens from the far north are considerably larger than those from more southern localities. Hence American specimens from the arctic regions are much larger than specimens from the Scottish Highlands or from Southern Scandinavia, as well as much larger than Newfoundland specimens. On the other hand, specimens from Lapland are as large as those from Greenland and the arctic shores of America, while the Scottish and Scandinavian specimens scarcely differ in size from those from Newfoundland and the shores of the Great Slave Lake.

The actual differences between the European and American forms, judging from the limited material before me, seem, as already stated, to be

\* Brown (R.), Proc. Zool. Soc. Lond., 1868, 351.

† Faun. Sver. och Norges, 1, 423.

by no means very tangible, consisting mainly in slight differences in the color of the summer pelage, the American form being rather darker and less fulvous. The ears also appear to be rather longer. The specimens before me are too few to render it safe to predicate that these differences are constant and distinctive; but as they accord with the general law of the darker tints of the closely-allied American representatives of European forms, the *L. "glacialis"* of authors may be provisionally regarded as a varietal form of *L. timidus*.\*

As is the case in the Ermines and other animals that assume a white livery in winter, the change is more complete in the extreme northern representatives of the species than in the extreme southern ones. In Newfoundland, Ireland,† the Scottish Highlands, and in Southern Scandinavia, the change is often incomplete. Although authors almost universally describe the winter pelage as white to the base, it is well known that the *Lepus hibernicus* Bell was based on specimens from Ireland that remained brown in winter, and Nilsson's variety *canescens* (*L. variabilis* var. *canescens* Nilss.) of Sweden was based merely on southern specimens, in which the change to white in winter is only partial. In the Scottish and Scandinavian specimens before me, I observe the following stages of gradation in respect to the winter pelage. In only one or two is the whiteness of the under fur of that snowy purity seen in the specimens from Greenland, Labrador, and Arctic America, there being in nearly all a faint shade of brown. In some, it is so pale as to be scarcely appreciable; in others, quite strong. In the latter, a few black hairs are intermixed in the dorsal surface, which in some cases form quite a strongly-marked grayish area on the middle of the back. The specimens alluded to above vary as follows:—

No. 1737 (Coll. M. C. Z.), Sweden.—Pelage pure white to its base; front of ears pale grayish-brown.

No. 1776 (M. C. Z.), Sweden.—White, with a slight mixture of long black hairs on the back, and a faint brownish tinge below the surface; front of ears reddish-brown.

No. 1777 (M. C. Z.), Sweden.—A few black hairs in the dorsal surface, most numerous on the middle of the back, where they form a large grayish

\* As shown by the above-cited synonymy, the name *timidus* of Linnaeus has priority over *variabilis* of Pallas.

† "The Irish Hare only occasionally becomes white in winter".—(WATERHOUSE, Nat. Hist. Man., II. 54.)

area. Fur below the surface faintly shaded with brown; ears pale brown in front, washed with whitish.

No. 409 (Coll. S. I.), Sweden (Helsingland), January 29, 1847, ♀ (name on label "*Lepus variabilis* Pall., var. *borealis* Nilss.").—White, with a few black hairs intermixed, and a faint shade of brown below the surface.

No. 772 (S. I.), north of Scotland, January, 1855.—Middle portion of the under-fur slightly tinged with yellowish-brown. Anterior surface of ears yellowish gray-brown.

No. 777 (S. I.), north of Scotland, January, 1855.—Middle portion of fur of upper parts strongly tinged with yellowish-brown. Many black hairs in the dorsal surface, giving a rather strong dusky-grayish tint to the whole dorsal area, including the top of the head. Anterior face of ears black, washed with yellowish-brown. Many reddish-brown and dusky hairs on the feet, especially on the fore feet.

No. 411 (S. I.), Sweden, March, 1846, ad. ♂ (name on label "*Lepus variabilis* Pall., var. *canescens* Nilss.").—General color of the upper surface reddish-gray; under fur plumbeous at base; then pale yellowish-brown. Hairs white, many of them black-tipped.

In Nos. 1587 and 5181 (S. I.), winter specimens from Newfoundland, 1030 (S. I.), from Greenland, and 6961 and 6962 (S. I.), from Fort Rae, north shore of Great Slave Lake, the fur is pure white to the base. The black spot at the tip of the ear varies greatly in extent in different specimens, in some being reduced almost to obsolescence.

While at southern localities the winter pelage is more or less mixed with brown, on the other hand the animal frequently remains permanently white at extreme northern localities, as in Greenland (Fabricius) and Siberia (Gmelin). Sabine states, "In some of the full-grown specimens killed [on Melville Island] in the height of summer, the hair of the back and sides was of a grayish-brown towards the points, but the mass of the fur still remained white."\* A specimen before me (No. 3284, Coll. S. I.), from Arekamchichi Island, Bering's Straits, presents exactly this appearance, although evidently an adult summer specimen.

In young specimens, apparently but a few weeks old, the under fur is plumbeous at base, then pale grayish-fulvous. The hairs are subterminally tinged with whitish and narrowly tipped with black. A specimen from

\* Parry's [First] Voyage, suppl., 137.



Arctic America (No. 4583, S. I.) is intermediate in color between two others (Nos. 1779, M. C. Z., and 410, S. I.), from Sweden, except that in the former the feet are white, and in the latter of the same color as the body.

The subjoined tables of measurements, taken partly from specimens and partly compiled from authors, indicate a considerable range of both individual and geographical variation. The three skulls of *L. timidus* are from the extreme southern limit of the habitat of the species in Europe (excepting the mountains of Central Europe), and correspond both in size and proportions with the skull of *L. arcticus* from Newfoundland, the southern limit of the habitat of the latter. The Fort Anderson specimen is also but slightly larger than the one from Newfoundland. On the other hand, the Greenland, Melville Island, and Plover Bay specimens are very much larger, while the Yukon River specimens are intermediate, as are the geographical positions of the localities, the whole together forming an intergrading series. Between the largest (from Melville Island), with a length of 4.30 and a width of 2.08, and the smallest (from Newfoundland and Fort Rae), with a length of 3.55 and a width of 1.75, the difference is very considerable, and, without the intermediate specimens, might be regarded as indicating specific distinction.

The table of measurements of the animal are not wholly satisfactory, probably having all been made from skins; but doubtless furnish trustworthy data for the comparison of the two forms, the character of the material being the same for each. The variation in size in var. *timidus* ranges from 17 to 25.50 inches for the length of the body, and in var. *arcticus* from 22 to 26 inches. The single Lapland specimen of var. *timidus* corresponds very nearly in size with the Greenland, Baffin's Bay, Labrador, and Bering's Straits specimens of var. *arcticus*, while the Swedish and Scottish specimens are very near the size of the Newfoundland specimens. The ear appears to average rather larger in the var. *arcticus* series, but in no other respect are there any essential differences in proportions.

The *L. timidus* var. *arcticus* differs but little in its general proportions from *L. americanus*, but it is at once readily distinguishable by its much larger size. It also differs in the color of its winter pelage, that of *L. americanus* being plumbeous at base, then yellowish-brown, with only the surface white, while in *glacialis* the pelage is white to the base. It further differs from *L. americanus* in the proportions of the skull and in the form of the

nasal bones, which are about as wide anteriorly as posteriorly, while in *L. americanus* they are considerably narrowed anteriorly. While it is about the size of *L. campestris*, it is distinguished from that species by its much shorter ears and tail and shorter limbs, its very different color in summer, and in the much greater whiteness of its winter coat, the winter pelage of *L. campestris* being brown beneath the surface, with usually a broad grayish-brown area on the middle of the back. From all the other American species it is too distinct to require comparison with them.

**GEOGRAPHICAL DISTRIBUTION.**—The *L. timidus* (var. *timidus*) presents the rather unusual phenomenon among mammals of being found at isolated localities distant from its main range, in accordance with the law of the occurrence of arctic species in alpine regions far to the southward of the southern limit of the habitat of the same species in the lowlands; a law, however, often illustrated in the distribution of plants, birds, and insects. The var. *timidus* hence occurs in Ireland and the Highlands of Scotland, extending as far south as Cumberland; in the Swiss, Bavarian, and Tyrolese Alps; and in the Pyrenean and Caucasian Mountains; in the lower lands in Sweden and Norway; throughout Middle and Northern European Russia, Siberia, and thence northward to the shores of the Arctic Sea. The var. *arcticus* occurs as far southward as Newfoundland, where it reaches its southern limit of distribution on the Atlantic coast. It is found in Labrador, and occurs in the interior as far south as Fort Churchill on the western shore of Hudson's Bay, the northern shore of Great Slave Lake, and the Upper Yukon Valley, and inhabits the Barren Grounds northward to the Arctic coast. Although supposed by Dr. Bachman to occur in Nova Scotia and Northern Maine, I can find no evidence that such is the case. Its absence from Nova Scotia, on the contrary, is well authenticated. It hence meets, and to some extent overlaps, the habitat of *L. americanus*. According to Dr. Richardson and other northern explorers, it does not frequent the thick woods, but is often seen near the thin clumps of spruce-fir that border the Barren Grounds, the *L. americanus* being, on the contrary, a woodland species.

TABLE VI.—Measurements of skulls of *LEPUS TIMIDUS* var. *TIMIDUS*.

Catalogue-number.	Locality.	Sex.	Total length.	Greatest width.	Nasal bones, length.	Nasal bones, width behind.	Upper incisors from front to molars.	Upper incisors from front to hinder margin of palate.	Upper incisors, height.	Upper incisors, width between external edges.	Upper molars, length taken together.	Upper molars, distance between.	Lower jaw, length.	Lower jaw, height.	Remarks.
.....	London market	♂	3.58	1.80	1.35	0.71	1.19	.....	.....	.....	0.83	.....	.....	.....	From Waterhouse.
.....	do	♂	3.45	1.86	1.32	0.72	1.06	.....	.....	.....	0.83	.....	.....	.....	do.
1048	Sweden	♂	3.45	1.75	1.34	0.75	1.10	1.50	0.41	0.35	0.67	0.57	2.56	1.80	.....

TABLE VII.—Measurements of skulls of *LEPUS TIMIDUS* var. *ARCTICUS*.

Catalogue-number.	Locality.	Total length.	Greatest width.	Distance between orbits.	Nasal bones, length.	Nasal bones, width behind.	Nasal bones, width before.	Upper incisors from front to molars.	Upper incisors from front to hinder margin of palate.	Upper incisors, height.	Upper incisors, width between external edges.	Upper molars, length taken together.	Upper molars, distance between.	Lower jaw, length.	Lower jaw, height.	Remarks.
.....	Greenland	3.06	1.68	1.65	0.90	.....	.....	1.37	1.79	.....	.....	0.75	.....	3.17	1.71	From Waterhouse.
.....	do	3.87	1.99	1.48	1.67	0.86	.....	1.97	1.71	.....	.....	0.73	.....	2.96	1.86	do.
.....	do	3.59	1.87	1.33	1.36	0.79	.....	1.13	1.48	.....	.....	0.67	.....	2.60	1.76	do.
.....	Melville Island	4.30	2.06	1.65	1.75	0.94	.....	1.42	1.78	.....	.....	0.75	.....	3.31	1.83	do.
7130	Plover Bay, Northeastern Siberia.	4.90	2.05	1.66	0.86	1.00	.....	1.35	1.85	0.55	0.68	0.66	.....	2.95	2.18	.....
7218	Nulato, Yukon River	4.05	2.00	.....	1.70	0.86	0.80	1.32	1.80	0.58	0.35	0.75	0.62	2.95	2.00	.....
8645	Yukon River	4.00	2.02	.....	.....	.....	.....	1.85	1.67	.....	.....	.....	.....	2.93	2.05	.....
6190	do	3.85	2.00	.....	1.57	0.83	0.88	1.94	1.60	0.48	0.33	0.75	0.62	.....	.....	.....
6128	do	3.90	.....	.....	0.75	.....	.....	1.96	1.67	0.50	0.35	0.73	0.60	.....	.....	.....
7303	Fort Rae	3.85	1.99	.....	0.75	0.80	.....	1.36	1.67	0.50	0.35	0.70	0.63	2.66	.....	.....
6515	Fort Anderson	3.60	1.75	.....	1.60	0.80	0.84	1.18	1.55	0.47	0.37	0.70	0.53	2.60	1.65	.....
9277	Newfoundland	3.55	1.80	.....	1.45	0.80	0.80	1.18	1.40	0.45	0.35	0.70	0.57	2.50	1.70	.....

TABLE VIII.—Measurements of *LEPUS TIMIDUS* var. *TIMIDUS*.

Catalogue-number.	Locality.	Sex.	From tip of nose to—				Tail to end of—		Length of—		Height of ear.	Remarks.
			Eye.	Ear.	Occip.	Tail.	Verteb.	Hairs.	Fore foot.	Hind foot.		
.....	Lapland.....	.....	4.25	.....	.....	25.50	.....	4.25	.....	6.50	3.40	From Waterhouse.
.....	Ireland.....	.....	3.92	.....	.....	23.00	.....	4.00	.....	6.00	3.50	.....do.
.....	Scotland.....	.....	.....	.....	.....	22.50	.....	.....	.....	6.33	3.50	.....do.
.....	do.....	.....	.....	.....	.....	21.75	.....	.....	.....	6.25	3.50	.....do.
.....	do.....	♂	3.08	3.75	.....	20.00	3.00	4.25	5.00	6.00	3.67	.....do.
.....	do.....	♂	.....	.....	3.00	22.00	2.00	3.50	2.75	5.83	4.00	From Richardson.
778	do.....	.....	2.05	4.90	.....	19.00	.....	3.50	2.75	5.50	3.40	.....do.
771	do.....	.....	2.10	4.00	.....	17.00	.....	3.50	2.75	5.50	3.40	From Waterhouse.
.....	Sweden.....	.....	.....	.....	.....	21.00	.....	4.50	.....	6.50	4.25	.....do.
406	do.....	.....	2.25	4.25	3.00	21.50	1.80	3.50	3.00	6.50	4.50	.....do.
.....	do. (f).....	.....	2.00	4.00	.....	20.00	.....	.....	3.00	5.25	3.50	.....do.
1737	do. (f).....	.....	2.10	4.10	.....	20.00	.....	.....	3.00	5.80	3.75	.....do.
1776	do.....	♂	2.05	4.00	.....	24.00	1.75	3.50	2.75	6.00	4.00	.....do.
1777	do.....	.....	.....	.....	.....	18.00	.....	3.50	2.75	5.80	3.50	.....do.
409	do.....	♂	2.15	4.00	.....	22.00	1.75	3.50	3.10	6.40	4.00	L. "variabilis var. borealis."
410	do.....	♂	2.25	4.25	4.75	20.00	1.80	3.75	2.80	6.25	4.10	L. "variabilis var. canescens."

TABLE IX.—Measurements of *LEPUS TIMIDUS* var. *ARCTICUS*.

Catalogue-number.	Locality.	From tip of nose to—				Tail to end of—		Length of—		Height of ear.	Remarks.
		Eye.	Ear.	Occip.	Tail.	Verteb.	Hairs.	Fore foot.	Hind foot.		
1030	Greenland.....	2.50	.....	5.00	25.00	2.00	2.50	2.75	5.00	3.63	From Baird.
.....	Baffin's Bay.....	.....	.....	.....	26.00	.....	.....	.....	5.75	4.25	From Waterhouse.
3264	Arknahochi Island, Bering's Straits.	2.40	4.30	5.50	25.00	1.80	2.50	3.25	6.25	4.25	.....do.
.....	Labrador.....	.....	4.30	.....	26.00	1.75	3.50	3.75	6.50	4.75	From And. and Bach.
.....	do.....	.....	4.25	.....	26.00	.....	2.00	.....	6.00	4.25	From Waterhouse.
.....	do.....	.....	4.17	.....	25.00	.....	2.25	.....	6.00	4.00	.....do.
.....	Bear Lake, British America.	.....	.....	4.50	22.50	.....	2.50	.....	6.50	4.50	.....do.
6961	Fort Rae, Great Slave Lake.	.....	.....	.....	23.75	2.00	4.00	3.00	5.75	4.25	.....do.
6962	do.....	.....	.....	.....	24.25	.....	.....	2.20	5.50	4.30	.....do.
.....	do. (f).....	.....	.....	4.50	22.50	1.50	2.50	2.75	5.75	4.00	.....do.
.....	Newfoundland.....	.....	4.08	.....	24.00	.....	2.00	.....	6.00	4.00	From Waterhouse.
5181	do.....	2.50	4.50	.....	23.00	1.75	4.00	2.90	6.00	4.75	.....do.
323	do.....	2.30	.....	.....	23.00	.....	.....	.....	6.40	3.85	From Baird.
1567	do.....	.....	.....	5.00	26.00	2.00	4.00	3.10	6.20	4.10	.....do.

TABLE X.—List of specimens of *LEPUS TIMIDUS* var. *TIMIDUS*.

Catalogue-number.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Nature of specimen.	Remarks.
*1737	...	...	Europe (Sweden)	.....	L. Agassiz	Skin	
*1776	...	♂	Sweden	.....	William Schimper	Skin	
*1777	...	...	do	.....	do	Skin	
*1719	...	○	do, (?)	.....	do	Skin	
406	31	♀	do	June 4, 1846	Kongl. Svenska Akad.	Skin	L. "variabilis Pall. var. borealis Nilg."
409	32	♀	do	Jan. 20, 1847	do	Skin	do
410	33	○	do	Summer	do	Skin	L. "variabilis Pall. var. canescens Nilg."
411	34	♂	do	Mar. —, 1846	do	Skin	do
771	...	...	Scottish Highlands	Jan. —, 1833	Sir William Jardine	Skin	
772	...	...	do	Jan. —, 1833	do	Skin	
1048	...	...	Sweden	.....	do	Skull	

\* From the Museum of Comparative Zoology, Cambridge, Mass.

TABLE XI.—List of specimens of *LEPUS TIMIDUS* var. *ARCTICUS*.

Catalogue-number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by.	Nature of specimen.
6190	...	Yukon	.....	.....	.....	Skull.
6193	...	do	.....	.....	.....	Skull.
7218	...	Nulato, Yukon River	.....	H. Kennicott	H. Kennicott	Skull.
8645	...	Yukon River	.....	W. H. Dall	W. H. Dall	Skull.
7803	...	Fort Rae	.....	E. E. Rose	.....	Skull.
6515	...	Fort Anderson	.....	do	.....	Skull.
7130	...	Plover Bay, Northeastern Siberia	.....	W. H. Dall	W. H. Dall	Skull.
2277	...	Newfoundland	.....	J. M. Skues	.....	Skull.
1030	...	Greenland	Winter	S. Steenberg	.....	Skin.
6961	...	Barren Grounds north of Fort Rae, Gr. at Slave Lake.	Winter, 1898	E. E. Rose	L. Clarke	Skin.
6960	...	do	do	do	do	Skin.
5181	...	Newfoundland	Winter, 1890	.....	J. E. Willis	Skin.
353	...	do	Winter	J. G. Bell	.....	Skin.
1587	...	do	do	.....	J. M. Skues	Skin.
1326	○	do	Summer	.....	J. Downes	Skin.

## LEPUS CAMPESTRIS Bachman.

## Prairie Hare.

- Lepus variabilis* LEWIS, Barton's Med. and Phys. Journ., ii, 1806, 159.—GODMAN, Am. Nat. Hist., ii, 1826, 160.  
*Lepus virginianus* var. ? HARLAN, Faun. Amer., 1895, 310.  
*Lepus virginianus* RICHARDSON, Faun. Bor.-Am., i, 1829, 224.—PRINCE MAXIMILIAN, Reise in das innere Nord-Amer., i, 1839, 508.  
*Lepus campestris* BACHMAN, Journ. Acad. Nat. Sci. Phila., vii, 1837, 349; viii, 1839, 90.—WATERHOUSE, Nat. Hist. Mam., ii, 1848, 127.—GIEBEL, Säuget., 1865, 449.—BAIRD, Mam. N. Am., 1867, 585, pl. lvi, fig. 2 (skull).—NEWBERRY, Pacific R. R. Ex. and Surv., vi, iv, 1867, 62.—COOPER, Pacific R. R. Ex. and Surv., xii, iii, 1860, 104.—SUCKLEY, Pacific R. R. Ex. and Surv., xii, iii, 1860, 131.—MAXIMILIAN, Wieg. Arch., 1861, Bd. i, 145.—HAYDEN, Trans. Am. Phil. Soc. Phila., xii, 1862, 148.—GRAY, Ann. and Mag. Nat. Hist., 3d series, xx, 1867, 224.—ALLEN, Bull. Essex Institute, vi, 1874, 52, 58, 61, 66.  
*Lepus townsendi* BACHMAN, Journ. Acad. Nat. Sci. Phila., viii, 1839, 90, pl. ii; Townsend's Narrative, 1839, 325.—AUD. & BACH., Quad. N. Am., i, 1849, 25, pl. iii.—COOPER, Am. Nat., ii, 1868, 536.

*In winter*, white, more or less tinged with yellowish-brown on the middle of the back; top of the head and anterior surface of the ears pale yellowish-brown, varying to whitish; ears tipped with black. Under fur white at the base, passing through pale yellowish-brown to deep reddish-brown. The hairs of the back white at the tip, with a subterminal band of brown, varying in different specimens from yellowish-brown to dark reddish-fuscous.

*In summer*, entire upper parts, breast, anterior surface of the ears, and the legs pale yellowish-gray, this color gradually passing into white on the sides. Fur of the under parts, excepting the breast, pure white to the roots. Nape and lower two-thirds of the ears white; upper third of the ears brownish-black. Fringes of the ears creamy-brown, bordered with white. Sides and ends of the muzzle yellowish-brown. Tail white on both surfaces, with occasionally a faint, median, ashy line above. Occasionally, a small oval spot of white on the middle of the forehead. The under fur of the upper surface in summer varies in different specimens from whitish-gray to grayish-plumbeous at base, then pale fulvous, passing into black. The hairs are generally black at the extreme tip, with a broad subterminal bar of pale yellowish-gray; below, the black bar passes gradually into whitish at the base. A few hairs entirely black are generally intermixed. The tail is very long, equaling the length of the head. Ears very long, about one-fourth longer than the head. Hind feet rather longer than the ears. Length of the body, 19 to 23 inches; of the tarsus, 5.50 to 6 inches; of the ear, 4.75 to nearly 6 inches.

Of some fifteen specimens before me in winter pelage, not more than one in five has the whole dorsal surface pure white. The reddish-brown subterminal zone shows through the white tips of the hairs more or less in nearly all

the specimens, while there is generally a well-marked brownish area on the middle of the back, which varies in tint from pale yellowish-brown to dark reddish-brown and even reddish-fuscos. Generally, the upper surface of the head and the anterior surface of the ears are but little lighter-colored than in summer; but there is in some a broad band running from the base of the ears to the nose, on each side of the head, more or less nearly pure white, and occasionally the whole upper surface of the head is yellowish-white. From the dates on the labels, this species appears to assume its winter dress in November, as I have observed it to do in Southwestern Wyoming; but in Northwestern Kansas I found that a considerable proportion of the individuals observed retained nearly their summer colors in midwinter; they then have a much fuller, softer coat than in summer, and the general color of the upper surface, the sides of the body, and the limbs is much more strongly suffused with fulvous than in summer specimens. The under fur is also very thick and silky, and pure white, instead of being more or less plumbeous, as in summer. In the specimens from more northern localities, every degree of whiteness is presented, from those that are scarcely lighter than in summer to those which have a uniformly nearly pure white surface.

In summer, the color of the dorsal surface varies considerably in respect to the intensity of the yellowish suffusion; in some, it is so faint as to be scarcely appreciable, while in others it presents a pale golden hue. In several specimens from Ogden, Utah, and in one from Fort Crook, California, this suffusion partakes of a faint reddish tint, and there is a more decided grayish line on the upper surface of the tail than in those from the plains east of the Rocky Mountains.

Several very young specimens from the valley of the Yellowstone do not differ essentially in color from the adult.

This species was first described by Lewis and Clarke, in 1814, in the history of their expedition across the continent (vol. ii, p. 178), but they omitted to give it a distinctive name. Harlan, in 1825, copied their description, indicating the species, however, merely as "*Lepus virginianus*, var. 1"; thus partially confounding it with his *Lepus virginianus* (= *L. americanus* auct.), or the White Hare of the Eastern States. Dr. Richardson, while recognizing it as distinct from the *L. americanus*, identified it with Harlan's *Lepus virginianus*, he not only redescribing it from a "mutilated winter skin"; but also quoting Lewis and Clarke's description. In 1837, Dr. Bachman

gave it the name of *Lepus campestris*, quoting the descriptions both of Richardson and Lewis and Clarke, after having previously partially confounded it with Harlan's *L. virginianus*. Two years later, Dr. Bachman redescribed it under the name of *Lepus Townsendi*, from a specimen brought by Townsend from the Walla-Walla, one of the sources of the Columbia River, supposing it to be a species that never became white. Later, however (in Audubon and Bachman's *Quadrupeds of North America*, vol. i, p. 30), he doubted its distinctness from the *L. campestris*, having subsequently been assured that it did assume a white dress in winter. Professor Baird, in 1857, with specimens before him from the vicinity of Fort Union, in both states of pelage, whence some of Audubon and Bachman's specimens were obtained, unhesitatingly regarded *L. Townsendi* as a synonym of *L. campestris*. From the labels on the specimens in the collection of the Smithsonian Institution, however, he seems to have later changed his opinion, retaining the name of *L. Townsendi* for the long-legged, long-eared Prairie Hare of Richardson, and restricting the name *campestris* to the representatives of *L. americanus* received from the fur countries, as will be further noticed under the head of that species. Professor Baird now, however, agrees with the writer that this later identification of *L. campestris* is erroneous.

The history of *L. campestris* was more or less confounded by Harlan with that of *L. americanus*, and later by Bachman, who first described it under the name of *L. virginianus*, while Godman confounded both this species and the *L. americanus* with the *L. "variabilis"* of the Old World. To Dr. Richardson belongs the credit of first recognizing the subject of the present article as a species distinct from *L. americanus*, and to which later Bachman gave the name of *L. campestris*.

*Lepus campestris* is at once distinguishable from the other species of varying Hares by the great length of its ears and tail, and by the latter being always white on both surfaces. It is of about the size of *L. timidus*, and is hence much larger than *L. americanus*, and rarely assumes so white a tint in winter as these two more northern species. From the other American long-tailed, long-eared, and long-limbed Hares (*L. callotis* and *L. californicus*), it differs in general color, in the white upper surface of the tail, and in changing to white in winter. It also differs notably in the proportions of the skull, as already noticed.

GEOGRAPHICAL DISTRIBUTION.—The most eastern locality whence this



species has been received is Fort Riley, Kansas. Further north, it extends eastward to the Missouri River and westward nearly to the Pacific coast. Lewis and Clarke observed it on the plains of the Columbia, where, according to Nuttall (as quoted by Bachman), it is abundant. Townsend obtained specimens on the Walla-Walla, and Dr. George Suckley on the eastern slope of the Blue Mountains of Oregon\* and on the plains of the Columbia east of the Cascades. Dr. Suckley also speaks of it as occurring on the sage-plains north of Fort Boise.† Dr. J. G. Cooper speaks of it as common south of the Columbia and Snake Rivers, but rare of late years to the northward of these rivers‡ A single specimen in the collection of the Smithsonian Institution, from Fort Crook, California, indicates its occurrence in Northern California. I found it abundant in Salt Lake Valley, Utah, and throughout Southern Wyoming and Northern Kansas eastward to within two hundred miles of the Missouri River. To the northward, it extends to the plains of the Saskatchewan, where, according to Richardson, it is abundant. Dr. Coues brought in specimens collected along the forty-ninth parallel, where he found it common.§ Its limit to the southward is not so well known, but no specimens have been received from south of Middle Kansas and the Great Salt Lake Basin; south of these points, it is wholly replaced by the *L. callotis* var. *texianus*, whose range somewhat overlaps that of *L. campestris*. It is eminently a species of the great sage-plains, and its main range seems to be from Middle Kansas northward to the plains of the Saskatchewan, and from the eastern edge of the great plains westward to the Sierra Nevada Mountains.

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\* Pacific R. R. Rep. & Expl., xii, pt. ii, p. 131.

† Pacific R. R. Rep. & Expl., xii, pt. ii, pp. 104, 131.

‡ Am. Nat., ii, 536.

§ Dr. Coues has published a monographic sketch of this species, inadvertently overlooked in preparing the bibliographical résumé of the subject which has been given on a preceding page. See Bull. Essex Inst., vii, 1875, p. 73 of seq.

TABLE XII.—Measurements of skulls of LEPUS CAMPESTRIS.

Catalogue number.	Corresponding number of skin.	Locality.	Sex.	Total length.	Greatest width.	Distance between orbits.	Nasal bones, length.	Nasal bones, width behind.	Nasal bones, width before.	Upper incisors from front to nostrils.	Upper incisors, distance of palates.	Upper incisors, length.	Upper incisors, width between external edges.	Upper incisors, length taken together.	Upper molars, distance between.	Lower jaw, length.	Lower jaw, height.
971	68	Fort Union.....	.....	1.83	0.90	1.00	0.87	0.94	1.18	1.63	0.45	0.36	0.71	0.55	2.60	1.82	
979	.....	do.....	.....	1.80	0.75	1.55	0.75	0.84	1.30	1.50	0.46	0.36	0.63	0.55	2.50	1.65	
1328	.....	Fort Kearney.....	.....	2.65	1.76	0.80	1.58	0.88	1.18	1.55	0.48	0.35	0.68	0.54	.....	.....	
1995	833	Fort Pierre, Nebr.	.....	3.37	1.73	0.75	1.37	0.78	0.80	1.18	1.38	0.45	0.33	0.48	.....	.....	
2398	1900	Fort Riley, Kans.	.....	3.95	1.65	0.80	1.30	0.73	0.66	1.00	1.38	0.40	0.36	0.66	0.55	2.95	1.60
3808	.....	Upper Missouri.....	.....	3.65	1.60	0.75	.....	0.77	.....	1.14	1.50	0.46	0.35	0.67	0.50	2.48	1.60
3343	3396	Fort Laramie.....	.....	3.73	1.65	0.77	1.60	0.87	0.90	1.95	1.37	0.47	0.40	0.68	0.97	2.58	1.66
4130	3133	Platte River.....	♀	3.80	1.84	0.75	1.65	0.85	0.98	1.93	1.50	0.45	0.37	0.70	0.60	.....	.....
4244	.....	Deer Creek, Nebr.	.....	3.47	1.70	0.80	1.33	0.70	0.80	1.16	1.45	0.45	0.33	0.60	0.56	2.40	1.56
4245	4235	do.....	.....	3.35	1.75	0.8	1.37	0.76	0.70	1.05	1.48	0.43	0.34	0.63	0.53	2.25	1.50
4247	.....	do.....	.....	3.55	1.76	0.83	1.50	0.80	0.84	1.15	1.50	0.43	0.37	0.65	0.53	2.40	1.60
4248	4244	do.....	.....	3.40	1.70	0.65	1.45	0.70	0.78	1.18	1.45	0.45	0.35	0.58	0.55	2.25	1.58
4249	4246	do.....	.....	3.38	1.75	0.75	1.33	0.75	0.74	1.05	1.38	0.44	0.35	0.67	0.55	2.30	1.60
4251	4250	do.....	.....	3.43	1.73	0.63	1.46	0.67	.....	1.10	1.43	0.47	0.34	0.65	0.50	2.40	1.60
4252	.....	do.....	.....	3.65	1.78	0.83	1.68	0.88	1.18	1.53	0.45	0.48	0.70	.....	2.37	1.75	

TABLE XIII.—Measurements of LEPUS CAMPESTRIS.

Catalogue number.	Original number.	Locality.	Sex.	From tip of nose to—				Tail to end of—		Length of—		Height of ear.	Remarks.
				Eye.	Ear.	Occip.	Tail.	Verteb.	Hairs.	Fore foot.	Hind foot.		
83	.....	Columbia River, Oregon Territory.	.....	.....	3.00	.....	21.00	3.25	5.50	.....	5.42	5.00	From Baird.
2820	1728	Percy, Carbon County, Wyoming Territory.	♂	2.25	3.50	4.30	22.40	.....	.....	3.00	6.00	5.50	Measured fresh.
2856	1729	do.....	♂	2.25	3.40	3.80	22.50	3.25	6.00	2.80	5.50	5.45	do.
2855	1730	do.....	♂	.....	3.25	4.00	21.00	2.50	5.00	2.60	5.60	5.35	do.
2853	1748	do.....	♂	2.35	3.25	3.85	20.25	3.70	5.50	2.85	5.75	4.80	do.
2854	1681	do.....	♂	2.70	3.60	3.80	19.75	2.80	4.75	2.80	5.00	5.00	do.
2858	1680	do.....	♂	2.35	3.30	3.55	20.00	2.00	4.50	2.90	5.65	5.00	do.
2857	1689	do.....	♂	2.00	3.50	3.90	19.75	2.75	5.00	3.00	5.70	5.40	do.
.....	1679	do.....	♂	2.50	3.40	3.80	20.00	2.00	4.25	2.80	5.65	5.35	do.
2763	1595	Fort Fred Steele, Wyoming Territory.	♂	2.50	.....	4.05	19.50	3.25	4.50	2.67	5.90	5.35	do.
2765	1415	Ogden, Utah.....	♀	2.10	.....	3.75	21.00	2.00	5.00	3.35	5.35	.....	do.
2764	1395	do.....	♂	.....	3.90	20.00	3.00	4.90	3.10	6.00	5.85	.....	do.
.....	.....	Powder River.....	.....	2.00	4.50	21.00	2.50	4.25	5.50	5.75	5.25	.....	From Baird.
1794	.....	do.....	.....	2.25	4.50	22.25	3.25	4.50	3.00	6.00	5.00	.....	do.
69	.....	Fort Union, Upper Missouri.	.....	4.17	.....	20.00	2.90	4.25	.....	5.25	4.90	.....	Skin.
1290	.....	Cascha la Poudre Creek.....	♀	.....	5.00	22.00	3.75	5.50	.....	5.55	4.35	.....	do.
450	.....	Bridger's Pass.....	♂	.....	4.50	20.50	3.00	5.50	.....	5.55	.....	.....	do.
450	.....	Walla-Walla.....	♂	2.00	4.50	21.00	3.25	5.50	.....	5.50	4.75	.....	From Bachman.
.....	.....	Upper Missouri.....	♂	.....	4.48	21.50	3.18	4.75	.....	5.45	5.80	.....	From Aud. and Bach.
.....	.....	do.....	♀	.....	.....	21.00	3.00	4.80	.....	5.25	.....	.....	do.
4239	64	Deer Creek, Nebraska.....	♀	2.50	.....	5.00	22.50	3.50	.....	2.85	.....	.....	Measured fresh.
4240	.....	do.....	♂	2.75	.....	5.25	22.50	3.50	.....	3.00	.....	.....	do.
4242	57	do.....	♀	2.50	.....	4.50	21.50	4.00	.....	.....	.....	.....	do.
4245	58	do.....	♂	2.50	.....	4.50	21.50	3.00	.....	.....	.....	.....	do.
2908	52	Fort Kearney, Nebraska.....	.....	.....	.....	2.00	22.00	3.75	5.75	.....	.....	.....	do.
12016	4269	Three Buttes.....	♀	2.25	4.00	4.50	18.00	2.00	7.00	2.75	5.75	5.00	do.

TABLE XIV.—List of specimens of *LEPUS CAMPESTRIS*

Catalogue-number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.	Remarks.
69	971	...	...	Fort Union, Dak.	...	T. Culbertson.	T. Culbertson.	Skin and skull	...
66	973	...	...	do	...	Capt. W. F. Reynolds.	Dr. F. V. Hayden.	do	...
...	...	...	...	do	...	do	do	do	...
823	1265	...	...	Fort Pierre, Dak.	...	...	Dr. J. Evans.	do	...
1900	5206	...	...	Fort Kearney, Nebr.	...	...	...	do	...
3253	3343	...	...	Fort Riley, Kans.	...	...	...	do	...
4237	4444	...	...	Fort Laramie, Nebr.	...	...	...	do	...
4239	4445	...	...	Dear Creek, Wyo.	...	...	...	do	...
4240	4446	...	...	do	...	...	...	do	...
4241	4447	...	...	do	...	...	...	do	...
4242	4448	...	...	do	...	...	...	do	...
4243	4449	...	...	do	...	...	...	do	...
4244	4450	...	...	do	...	...	...	do	...
4245	4451	...	...	do	...	...	...	do	...
4246	4452	...	...	do	...	...	...	do	...
4247	4453	...	...	do	...	...	...	do	...
4248	4454	...	...	do	...	...	...	do	...
4249	4455	...	...	do	...	...	...	do	...
4250	4456	...	...	do	...	...	...	do	...
4251	4457	...	...	do	...	...	...	do	...
4252	4458	...	...	do	...	...	...	do	...
4253	4459	...	...	do	...	...	...	do	...
4254	4460	...	...	do	...	...	...	do	...
4255	4461	...	...	do	...	...	...	do	...
4256	4462	...	...	do	...	...	...	do	...
4257	4463	...	...	do	...	...	...	do	...
4258	4464	...	...	do	...	...	...	do	...
4259	4465	...	...	do	...	...	...	do	...
4260	4466	...	...	do	...	...	...	do	...
4261	4467	...	...	do	...	...	...	do	...
4262	4468	...	...	do	...	...	...	do	...
4263	4469	...	...	do	...	...	...	do	...
4264	4470	...	...	do	...	...	...	do	...
4265	4471	...	...	do	...	...	...	do	...
4266	4472	...	...	do	...	...	...	do	...
4267	4473	...	...	do	...	...	...	do	...
4268	4474	...	...	do	...	...	...	do	...
4269	4475	...	...	do	...	...	...	do	...
4270	4476	...	...	do	...	...	...	do	...
4271	4477	...	...	do	...	...	...	do	...
4272	4478	...	...	do	...	...	...	do	...
4273	4479	...	...	do	...	...	...	do	...
4274	4480	...	...	do	...	...	...	do	...
4275	4481	...	...	do	...	...	...	do	...
4276	4482	...	...	do	...	...	...	do	...
4277	4483	...	...	do	...	...	...	do	...
4278	4484	...	...	do	...	...	...	do	...
4279	4485	...	...	do	...	...	...	do	...
4280	4486	...	...	do	...	...	...	do	...
4281	4487	...	...	do	...	...	...	do	...
4282	4488	...	...	do	...	...	...	do	...
4283	4489	...	...	do	...	...	...	do	...
4284	4490	...	...	do	...	...	...	do	...
4285	4491	...	...	do	...	...	...	do	...
4286	4492	...	...	do	...	...	...	do	...
4287	4493	...	...	do	...	...	...	do	...
4288	4494	...	...	do	...	...	...	do	...
4289	4495	...	...	do	...	...	...	do	...
4290	4496	...	...	do	...	...	...	do	...
4291	4497	...	...	do	...	...	...	do	...
4292	4498	...	...	do	...	...	...	do	...
4293	4499	...	...	do	...	...	...	do	...
4294	4500	...	...	do	...	...	...	do	...
4295	4501	...	...	do	...	...	...	do	...
4296	4502	...	...	do	...	...	...	do	...
4297	4503	...	...	do	...	...	...	do	...
4298	4504	...	...	do	...	...	...	do	...
4299	4505	...	...	do	...	...	...	do	...
4300	4506	...	...	do	...	...	...	do	...
4301	4507	...	...	do	...	...	...	do	...
4302	4508	...	...	do	...	...	...	do	...
4303	4509	...	...	do	...	...	...	do	...
4304	4510	...	...	do	...	...	...	do	...
4305	4511	...	...	do	...	...	...	do	...
4306	4512	...	...	do	...	...	...	do	...
4307	4513	...	...	do	...	...	...	do	...
4308	4514	...	...	do	...	...	...	do	...
4309	4515	...	...	do	...	...	...	do	...
4310	4516	...	...	do	...	...	...	do	...
4311	4517	...	...	do	...	...	...	do	...
4312	4518	...	...	do	...	...	...	do	...
4313	4519	...	...	do	...	...	...	do	...
4314	4520	...	...	do	...	...	...	do	...
4315	4521	...	...	do	...	...	...	do	...
4316	4522	...	...	do	...	...	...	do	...
4317	4523	...	...	do	...	...	...	do	...
4318	4524	...	...	do	...	...	...	do	...
4319	4525	...	...	do	...	...	...	do	...
4320	4526	...	...	do	...	...	...	do	...
4321	4527	...	...	do	...	...	...	do	...
4322	4528	...	...	do	...	...	...	do	...
4323	4529	...	...	do	...	...	...	do	...
4324	4530	...	...	do	...	...	...	do	...
4325	4531	...	...	do	...	...	...	do	...
4326	4532	...	...	do	...	...	...	do	...
4327	4533	...	...	do	...	...	...	do	...
4328	4534	...	...	do	...	...	...	do	...
4329	4535	...	...	do	...	...	...	do	...
4330	4536	...	...	do	...	...	...	do	...
4331	4537	...	...	do	...	...	...	do	...
4332	4538	...	...	do	...	...	...	do	...
4333	4539	...	...	do	...	...	...	do	...
4334	4540	...	...	do	...	...	...	do	...
4335	4541	...	...	do	...	...	...	do	...
4336	4542	...	...	do	...	...	...	do	...
4337	4543	...	...	do	...	...	...	do	...
4338	4544	...	...	do	...	...	...	do	...
4339	4545	...	...	do	...	...	...	do	...
4340	4546	...	...	do	...	...	...	do	...
4341	4547	...	...	do	...	...	...	do	...
4342	4548	...	...	do	...	...	...	do	...
4343	4549	...	...	do	...	...	...	do	...
4344	4550	...	...	do	...	...	...	do	...
4345	4551	...	...	do	...	...	...	do	...
4346	4552	...	...	do	...	...	...	do	...
4347	4553	...	...	do	...	...	...	do	...
4348	4554	...	...	do	...	...	...	do	...
4349	4555	...	...	do	...	...	...	do	...
4350	4556	...	...	do	...	...	...	do	...
4351	4557	...	...	do	...	...	...	do	...
4352	4558	...	...	do	...	...	...	do	...
4353	4559	...	...	do	...	...	...	do	...
4354	4560	...	...	do	...	...	...	do	...
4355	4561	...	...	do	...	...	...	do	...
4356	4562	...	...	do	...	...	...	do	...
4357	4563	...	...	do	...	...	...	do	...
4358	4564	...	...	do	...	...	...	do	...
4359	4565	...	...	do	...	...	...	do	...
4360	4566	...	...	do	...	...	...	do	...
4361	4567	...	...	do	...	...	...	do	...
4362	4568	...	...	do	...	...	...	do	...
4363	4569	...	...	do	...	...	...	do	...
4364	4570	...	...	do	...	...	...	do	...
4365	4571	...	...	do	...	...	...	do	...
4366	4572	...	...	do	...	...	...	do	...
4367	4573	...	...	do	...	...	...	do	...
4368	4574	...	...	do	...	...	...	do	...
4369	4575	...	...	do	...	...	...	do	...
4370	4576	...	...	do	...	...	...	do	...
4371	4577	...	...	do	...	...	...	do	...
4372	4578	...	...	do	...	...	...	do	...
4373	4579	...	...	do	...	...	...	do	...
4374	4580	...	...	do	...	...	...	do	...
4375	4581	...	...	do	...	...	...	do	...
4376	4582	...	...	do	...	...	...	do	...
4377	4583	...	...	do	...	...	...	do	...
4378	4584	...	...	do	...	...	...	do	...
4379	4585	...	...	do	...	...	...	do	...
4380	4586	...	...	do	...	...	...	do	...
4381	4587	...	...	do	...	...	...	do	...
4382	4588	...	...	do	...	...	...	do	...
4383	4589	...	...	do	...	...	...	do	...
4384	4590	...	...	do	...	...	...	do	...
4385	4591	...	...	do	...	...	...	do	...
4386	4592	...	...	do	...	...	...	do	...
4387	4593	...	...	do	...	...	...	do	...
4388	4594	...	...	do	...	...	...	do	...
4389	4595	...	...	do	...	...	...	do	...
4390	4596	...	...	do	...	...	...	do	...
4391	4597	...	...	do	...	...	...	do	...
4392	4598	...	...	do	...	...	...	do	...
4393	4599	...	...	do	...	...	...	do	...
4394	4600	...	...	do	...	...	...	do	...
4395	4601	...	...	do	...	...	...	do	...
4396	4602	...	...	do	...	...	...	do	...
4397	4603	...	...	do	...	...	...	do	...
4398	4604	...	...	do	...	...	...	do	...
4399	4605	...	...	do	...	...	...	do	...
4400	4606	...	...	do	...	...	...	do	...
4401	4607	...	...	do	...	...	...	do	...
4402	4608	...	...	do	...	...	...	do	...
4403	4609	...	...	do	...	...	...	do	...
4404	4610	...	...	do	...	...	...	do	...
4405	4611	...	...	do	...	...	...	do	...
4406	4612	...	...	do	...	...	...	do	...
4407	4613	...	...	do	...	...	...	do	...
4408	4614	...	...	do	...	...	...	do	...
4409	4615	...	...	do	...	...	...	do	...
4410	4616	...	...	do	...	...	...	do	...
4411	4617	...	...	do	...	...	...	do	...
4412	4618	...	...	do	...	...	...	do	...
4413	4619	...	...	do	...	...	...	do	...
4414	4620	...	...	do	...	...	...	do	...
4415	4621								

TABLE XIV.—List of specimens of *LEPUS CAMPESTRIS*—Continued.

Catalogue No.	Corresponding No. of skin.	Original num. ber.	Sex and age.	Locality.	When col- lected.	From whom received.	Collected by—	Nature of specimen.	Remarks.
13881	.....	4364	.....	Chief Mountain, R. M., lat. 40° N.	Aug. 10, 1874	A. Campbell	Dr. E. Cass	Skin	.....
7810	.....	6065	♂	Forapineo River, Mont.	June 26, 1874	do	do	do	do
13813	.....	4134	♂	Frenchman's Creek, Mont.	July 5, 1874	do	do	do	do
13916	.....	4369	♀	Three Buttes, Mont.	Aug. 8, 1874	do	do	do	do
13880	.....	4337	.....	do	Aug. 8, 1874	do	do	do	do
13815	.....	4375	♀	do	Aug. 9, 1874	do	do	do	do
13914	.....	.....	.....	Frenchman's River, Mont.	July —, 1874	do	do	do	do
13910	.....	4409	♀	do	July 10, 1874	do	do	do	do
5771	.....	.....	.....	do	Aug. 20, 1870	Dr. F. V. Hayden	W. T. Schmidt	do	do
5775	.....	.....	.....	Springwater	Aug. 20, 1870	do	do	do	do
5776	.....	.....	.....	Camp Collins, Wyo.	Oct. 20, 1870	do	do	do	do
11341	.....	3804	♂	Medicine Bow Mountains	July 25, —	Lieut. F. T. Bryan	Dr. W. A. Hammond	Skin and skull	.....
1388	.....	.....	.....	Kanab, Utah	Nov. 25, 1878	Lieut. G. M. Wheeler	Lieut. W. L. Marshall	do	.....
1389	.....	.....	.....	Brigler's Pass	.....	.....	.....	do	.....
7809	.....	.....	.....	Coyote, Kans.	Jan. —, 1872	Rocky Mountain Expedition	Allen and Bennett	Skin	Brown pelage.
7770	.....	.....	.....	do	Jan. —, 1872	do	do	do	do
7754	.....	627	♀	Deer Creek, Colorado	July 10, 1871	do	do	do	do
7768	.....	502	.....	Cheyenne, Wyo.	Aug. 13, 1871	do	do	do	do
7853	.....	1748	.....	Ferry, Wyo.	Dec. 10, 1871	do	do	do	do
7854	.....	1661	♂	do	Nov. 13, 1871	do	do	do	do
7855	.....	1729	♂	do	Nov. 27, 1871	do	do	do	do
7856	.....	1789	♂	do	Nov. 27, 1871	do	do	do	do
7857	.....	1623	.....	do	Nov. 13, 1871	do	do	do	do
7858	.....	1738	♂	do	Nov. 13, 1871	do	do	do	do
7859	.....	1679	♂	do	Nov. 13, 1871	do	do	do	do
7860	.....	1585	♂	Fort Fred Steele, Wyo.	Oct. 18, 1871	do	do	do	do
7864	.....	1385	♂	Ogden, Utah	Sept. 18, 1871	do	do	do	do
7865	.....	1415	♀	do	Sept. 18, 1871	do	do	do	do
3671	4394	.....	♀	Fort Creek, Cal.	.....	John Felner	John Felner	do	do
.....	1179	.....	.....	Klamath Lake, Oregon	.....	Lieut. R. S. Williamson	.....	do	do
.....	4469	.....	.....	Walla-Walla, Oregon	.....	United States Expl. Expt.	Dr. W. Simpson	do	do
.....	456	.....	♂	Saake River, Oregon	.....	Dr. George Suckley	Dr. George Suckley	do	do
.....	85	.....	.....	Columbia River	.....	J. K. Townsend	J. K. Townsend	do	Changing.

\* By clemens from Museum of Comparative Zoology.

## LEPUS AMERICANUS.

## Var. AMERICANUS.

## Northern Varying Hare.

- Lepus americanus* ERDMANN, Syst. Rep. Anim., 1777, 330 (based wholly on references to the Hudson's Bay specimens).—GMELIN, Syst. Nat., i, 1788, 162.—SHAW, Gen. Zool. Man., ii, 1801, 202.—DEMAR-EST, Mammalogie, 1822, 351 (in part only).—SABINE (J.), Franklin's First Journ., 1824, app. 664.—RICHARDSON, App. Parry's Second Voyage, 1825, 324; Faun. Bor.-Am., i, 1829, 217 (syn. in part only); Back's Arct. Land Exped., 1836, app. 496.—FISCHER, Syn. Mam., 1829, 376 (mixed with *L. sylvaticus*).—BACHMAN, Journ. Acad. Nat. Sci. Phila., vii, 1837, 403; viii, 1839, 76 (in part only).—DEKAY, New York Zool., i, 1842, 96 (in part only).—WAGNER, Suppl. Schreber's Säuget., iv, 1844, 104 (in part only).—WATERHOUSE, Nat. Hist. Mam., ii, 1848, 108 (in part only).—AUD. & BACH., Quad. N. Am., i, 1849, 93 (in part only).—GIBBEL, Säuget., 1855, 449.—BAIRD, Mam. N. Am., 1857, 579 (in part only).—GRAY, Ann. and Mag. Nat. Hist., 3d series, xx, 1867, 224 (in part).—MAXIMILIAN, Wiegmann, Arob., 1861, i, 142.—ROES, Can. Nat. and Geol., vi, 1867, 436.—WELCH, Proc. Zool. Soc. Lond., 1869, 228 (seasonal changes of color).—GILPIN, Proc. and Trans. Nov. Sco. Inst. Nat. Sci., iii, 1872, 46.
- Lepus hudsonius* PALLAS, Nov. Sp. Glires, 1778, 30.—BODDERT, Elench. Anim., i, 1784, 99.—ZIMMERMANN, Pennant's Arktische Zool., i, 1787, 96.
- Lepus nanus* SCHREBER, Säuget., ii, 1792, 881, pl. ccxxxiv, B (mixed with *L. sylvaticus*).
- Lepus campestris* BAIRD, MSS. in part (labels and record-books, Smiths. Inst.).—HAYDEN, Am. Nat., iii, 1869, 115.—DALL, Alaska and its Resources, 577.
- Lepus variabilis* var. GODMAN, Am. Nat. Hist., ii, 1896, 169 (in part only).
- Lepus borealis* SCHINTZ, Synop., ii, 1845, 286.
- American Hare*, FORSTER, Phil. Trans., lxii, 1772, 376.—PENNANT, Hist. Quad., 1781, no. 243; Arct. Zool., i, 1784, 95.

## Var. VIRGINIANUS.

## Southern Varying Hare.

- Lepus americanus* BACHMAN, Journ. Acad. Nat. Sci. Phila., vii, 1837, 403; viii, 1839, 76 (in part only).—DEKAY, New York Zool., i, 1842, 96, pl. xxvi, fig. 2 (in part only).—WAGNER, Suppl. Schreber's Säuget., 1844, iv, 104 (in part only).—AUD. & BACH., Quad. N. Am., i, 1849, 73, pl. xi, xii (in part only).—BAIRD, Mam. N. Am., 1857, 579 (in part only).—GRAY, Ann. and Mag. Nat. Hist., 3d ser., xx, 1867, 224 (in part only).—ALLEN, Bull. Mus. Comp. Zool., i, 1869, 237.—HALL, Can. Nat. and Geol., vi, 1861, 306.
- Lepus virginianus* HARLAN, Faun. Am., 1825, 196.—FISCHER, Synopsis, 376, 1829.—DOUGHTY, Doughty's Can. Nat. Hist., i, 1830, 217, pl. xix.—BACHMAN, Journ. Acad. Nat. Sci. Phila., vii, 1837, 301 (mainly; somewhat mixed with *L. campestris*).—EMMONS, Quad. Mam., 1840, 58.—THOMPSON, Nat. Hist. Vermont, 1842, 48.

## Var. WASHINGTONI.

## Western Varying Hare.

- Lepus washingtoni* BAIRD, Proc. Acad. Nat. Sci. Phila., vii, 1855, 333, pl. xv (animal); Mam. N. Am., 1857, 583.—COOPER, Pacific R. R. Ex. and Surv., xii, iii, 1860, 87.—SUCKLEY, Pacific R. R. Ex. and Surv., xii, iii, 1860, 103.—SUCKLEY & GIBBS, Pacific R. R. Ex. and Surv., xii, iii, 1860, 130.—GRAY, Ann. and Mag. Nat. Hist., 3d ser., xx, 1867, 224.
- Lepus americanus* var. *washingtoni* ALLEN, Proc. Bos. Soc. Nat. Hist., xvii, 1875, 434.

## Var. BAIRDI.

## Rocky Mountain Varying Hare.

- Lepus bairdi* HAYDEN, Amer. Nat., iii, 1860, 115.—MERRIAM, U. S. Geol. Surv., Sixth Ann. Rep., 1873, 667.
- Lepus americanus* var. *bairdi* ALLEN, Bull. Essex. Inst., vi, 1874, 61, 66; Proc. Bos. Soc. Nat. Hist., xvii, 1875, 434.

## Var. AMERICANUS.

## Northern Varying Hare.

*In winter*, white, except the extreme tips of the ears, which are narrowly bordered with black. Under-fur plumbeous at base, passing into rather

strong brownish-red apically. Hairs white for about the terminal third, then brownish-red, with the basal third plumbeous. In specimens from rather southern localities, the brown often shows through the white outer surface, particularly on the sides of the body.

*In summer*, above and outer surface of the limbs pale yellowish-brown, varied with black, resulting in a general tint of dark umber-brown. Tail sooty above, grayish-white below. Lower surface of the body, from the breast posteriorly, white; breast, and neck in front, yellowish-brown; chin and throat white. Anterior surface of ears yellowish-brown, mixed with black; apical fourth of the anterior border black; posterior border white or yellowish-white. Under-fur of the dorsal region plumbeous for the basal half, shading gradually into pale yellowish-brown. Hairs generally broadly tipped with black, the black tip succeeded by a broad bar of pale brown; below this to the roots black, shading more or less into plumbeous.

Length of body, 15 to 20 inches; length of ear about 3 inches; of tarsus about 5.25. Ear about three-fourths the length of the head; head about four-fifths the length of the tarsus. Average weight about 5½ pounds.

In winter specimens, the whiteness of the surface invades the pelage much more deeply than in var. *virginianus*, wholly concealing the subjacent brownish zone, the ears and the upper surface of the head being also pure white. The pelage is also much thicker and longer, and the ears are far more heavily clothed. The brown zone of the under-fur varies in different specimens from light fulvous-brown to deep reddish-brown.

Summer specimens vary chiefly in respect to the intensity of the yellowish-brown tint intermixed with the black, which ranges from yellowish-gray to pale rufous. The relative length of the black tips to the hairs of the dorsal surface also varies the general tint, which is often of a very dark umber-brown, quite different from the bright-cinnamon tint of summer specimens of var. *virginianus*.

Among the specimens of var. *americanus* is a single example of melanism, a mutilated skin (No. 6268) labeled as follows: "*Lepus americanus*, Rainy Lake, H. B. T." It is apparently a winter skin, the pelage being very long and full. The color is dull plumbeous-black throughout, there being a slight grayish cast to the surface of the pelage, particularly on the head, breast, and back. Although instances of melanism appear to be comparatively frequent in *Lepus europæus*, they are very rare among the American *Leporidae*.

The general measurements of the different varieties of *Lepus americanus* have been necessarily taken almost wholly from skins, and in part by different observers. They are hence less satisfactory than they would have been could they have been made from fresh specimens and by a single person.\* They are in the main, however, borne out by the measurements of the skulls. The material, being similar in all cases, affords doubtless a tolerably fair means of determining the individual range of variation and the amount of variation with locality. Contrary to what usually happens, there is in this species apparently no increase in size to the northward, some of the largest specimens being from New York, Pennsylvania, and Massachusetts, and belong to var. *virginianus*. The specimens from Maine (see measurements of the skulls) scarcely differ from those from the Fur Countries, and the specimens from the Wind River Mountains (var. *bairdi*) fully equal those from the most northern points.

In Table XV, the specimens are chiefly from very northern localities, and all in winter pelage. The average length of the body is 16 inches, varying from 15.25 to 17.10; length of hind foot 5.10, varying from 4.70 to 5.25; length of ear 2.70, varying from 2.25 to 3.00. Hence the average length of the body is about an inch and a quarter less than in the Massachusetts series (see below), while the difference in the hind foot and ear is less than one and a half tenths of an inch. The difference in length is more apparent than real, as the skins from Arctic America had never been filled, and are hence more contracted by drying than the others. The trifling difference in the size of other parts corresponds very nearly with that indicated by the skulls. According to Dr. Gilpin, Nova Scotia specimens range in length from 17.00 to 20.70 inches, and a specimen from the Fur Countries, of which Dr. Richardson gives measurements, had a length of 19.00 inches.

In Table XVI are given measurements of twenty-six skulls, mainly from the Mackenzie River district. Of these, the average length is 3.04 inches, the extremes being 2.30 and 2.87; the average breadth is 1.52 inches, the extremes being 1.67 and 1.45. The difference between the average of this series and that of another series of fourteen specimens from Oxford County,

\* In all the original measurements given in this paper, the dimensions are the distances in a straight line between the extremities of the parts measured, and are hence less than if measured over the convexities of the surface, as is often done. The height of the ear is taken by measuring from the inner base of the ear to the tip, instead of either from the anterior or posterior base, and is hence rather less than it would be by either of the other methods.

Maine, belonging to var. *virginianus* (see Table XIX), is practically nothing, being less than five one-hundredths of an inch!

A more detailed comparison of var. *americanus* with var. *virginianus*, and also with vars. *bairdi* and *washingtoni*, will be given later, with also general remarks on the synonymy of the several forms.

VAR. VIRGINIANUS.

*Southern Varying Hare*

Similar in size and proportions to var. *americanus*. Winter pelage with the white color of the surface extending less deeply, and the ears, head, and feet more or less varied with brown. In summer, more rufous, the color being rich reddish-brown or cinnamon-brown, instead of dark umber or sepia-brown. Winter pelage worn for a shorter time, and the seasonal change of color less complete.

Winter specimens vary greatly in respect to the depth of the whiteness of the upper surface. Some are pure white throughout, except the black edging of the tips of the ears, the whiteness extending so deeply as to wholly conceal the subjacent zone of brown. In others, the brown is visible through the surface, or is exposed by the slightest disarrangement of the pelage, and the ears remain more or less brownish, sometimes having but little more white than in summer. The upper surface of the head and the feet are also often reddish-brown. Occasionally, midwinter specimens are sometimes met with in which the colors of the summer pelage still predominate throughout. The assumption of the white pelage is not only less complete in var. *virginianus* than in var. *americanus*, but, as previously stated, the change begins later, and the winter livery is retained for a much shorter time. In Massachusetts, New York, and Northern Pennsylvania, the change rarely begins before the middle or last of November, and, occupying several weeks, is not completed till after the middle of December. In Nova Scotia, according to Dr. Gilpin,\* specimens in the earliest stages of change are generally not met with before the end of November; while, in New Brunswick, according to Dr. Welch,† the first stages of the change may be detected early in October, and by the first week of December the change is there fully completed. In the northern districts of the Fur Countries, according to Dr. Richardson,‡ the white winter pelage is assumed in October. At the southward, the winter

\* Proc. and Trans. Nova Scotia Inst. Nat. Sci., vol. III, i, p. 53.

† Proc. Zool. Soc. Lond., 1859.

‡ Faun. Bor.-Am., i, 918, p. 298.



dress is worn for only about four months, the vernal change beginning in March; in the middle districts, about five months, and in the higher latitudes about six, where the winter dress, according to Dr. Richardson, is worn till the end of April.

Summer specimens of var. *virginianus* from Massachusetts, New York, and Pennsylvania vary considerably in color through the varying intensity of the brown tints of the upper surface and the relative length of the black tips of the hairs. In some, the black tips are short and inconspicuous; in others, so long as to strongly vary the general color with black. The brown varies from pale yellowish-brown to dark reddish-brown, the brown tint of the under fur also similarly varying in intensity. The base of the under-fur varies from grayish to dark plumbeous.

The exact ranges of varieties *americanus* and *virginianus* cannot now be well determined, and, as in the case of other intergrading geographical forms, can probably never be absolutely defined. According to Dr. Gilpin, the Nova Scotia type seems clearly referable to the northern form (var. *americanus*). He describes the dorsal surface as being "sepia-brown, with a yellow wash", and observes that they present none of the bright reddish or cinnamon-brown mentioned by Professor Baird as characterizing more southern specimens. Dr. Gilpin's description hence corresponds very nearly with specimens from the Red River district, and from Fort Rae, Great Slave Lake, and hence with Dr. Richardson's description.

In Table XVII, the first fourteen specimens, all from Massachusetts (Coll. M. C. Z.), and all in winter pelage, vary in length of body from 14 to 20 inches; in length of hind foot, from 4.65 to 5.50; in length of ear, from 2.40 to 3.60: the average being, length, 17.37; hind foot, 5.24; ear, 2.83. Fifteen other specimens (Coll. S. I.),\* seven of which are also from Massachusetts, and the others from New York and Pennsylvania, range in length from 16 to 21 inches; hind foot, 4.57 to 5.68; ear, 3.00 to 3.60: averaging, length, 18.82; hind foot, 5.24; ear, 3.32. In length, the latter series exceeds the former by about one and a half inches, while the hind feet are equal; the difference in the length of the ear is nearly half an inch, one-half of which, at least, is due to the different way in which the measurements of the ear in the two series were taken, as shown by a remeasurement of some of the specimens of the latter series.

In Table XVIII are presented the measurements of twenty-three

\* Measurements copied from Baird's Mamm. N. Am.

skulls, from numerous localities. Fourteen are from Oxford County, Maine, and average 3.07 in length (the extremes 3.30 and 2.80) and 1.55 in breadth (extremes 1.62 and 1.40). Six other specimens, from different localities in Massachusetts, New York, and Pennsylvania, are the largest of the series, but they are all very old skulls, and are doubtless larger than the average for the localities which they represent, being collected by different individuals, and more likely than otherwise were saved from being regarded as "extra fine" specimens. They average 3.23 inches in length (extremes 3.35 and 3.10), and 1.60 in breadth (extremes 1.62 and 1.52).

As previously remarked under the head of var. *americanus*, there is practically no difference in size or proportions between the series of skulls from Maine and the fur countries.

Var. WASHINGTONI.

*Western Varying Hare.*

Rather smaller than var. *virginianus* (of which it is the exact western geographical representative), with the summer pelage of a somewhat stronger reddish tint; probably white in winter, except in the very mild region about Puget's Sound, where they have been observed to retain their summer pelage the whole year.\*

The differences between this form and var. *virginianus* are by no means well marked. In color, the tints of the summer pelage are perhaps rather stronger in the western form; but even the original specimens described by Professor Baird can be matched by specimens from Massachusetts. Both the skins and the skulls indicate a slightly smaller size for var. *washingtoni*; but unfortunately one only of the skulls is full grown (this is the largest of the series), the sutures of the others being still open, and their general appearance is that of specimens but a few months old. The range of var. *washingtoni* to the northward and eastward is by no means well known; neither are its relations with *L. bairdi* Hayden. A series of specimens, in winter pelage, collected by Dr. Kennerly (Nos. 5881-6, Coll. S. I.) during the Northwestern Boundary Survey, are remarkable for their whiteness, the basal plumbeous zone being lighter-colored and much reduced in extent, as compared with var. *americanus*; the subterminal fulvous-brown zone is of a more or less pale delicate salmon color, in some specimens nearly or quite obsolete, leaving the whole pelage of a snowy whiteness to the base, as in *L. timidus* var. *arcticus*. The beautiful snowy whiteness of these specimens is in

\* See Suckley, Pacific R. R. Rep., xii, iii, 130.

marked contrast with the mixed white and brown winter pelage of specimens from the Eastern States; and even the specimens from the highest northern localities, though pure white at the surface, are fulvous and then plumbeous beneath. These specimens agree, however, in this character with winter specimens from Fort Bridger, Fort Benton, and the Bitter Root Valley, which, from the locality, I have referred to var. *bairdi*, and are in no way distinguishable from them. I have also included specimens from "Koko-youkuk, R. Am.", in changing pelage, in this series, which they seem to approach quite strongly.

The skins of var. *washingtoni* vary in length of body from 15.25 to 18.50 inches, eight specimens giving an average of 16.63, or about one inch less than the average of var. *virginianus*, and half an inch more than specimens from the northern districts of the fur countries, or var. *americanus*. The ear fully equals, and the hind foot scarcely falls short, of the length of the same parts in var. *virginianus* from Massachusetts. The single fully adult skull fully equals the average of eastern examples. The measurements given in Table XIX are taken wholly from the skins, many of which are unfilled and evidently much shrunken. The measurements of the skulls (Table XX), as before stated, are mainly from more or less immature specimens. The proportions are not essentially different from those of eastern specimens of corresponding age, and the ears and tarsi are fully equal to these parts in var. *virginianus*, instead of being shorter, as has been supposed.

Var. BAIRDI.

*Rocky Mountain Varying Hare.*

Size and proportions same as those of the other varieties of *americanus*. Winter pelage sometimes wholly snowy-white to the base, as in the Arctic Hare; generally with the outer white zone extending much deeper than in any other form of *americanus*, with the middle zone much paler, varying from a faint shade of fulvous to a delicate salmon tint, and the basal plumbeous zone greatly reduced in extent, and lighter-colored. In summer, above pale grayish-brown and black, the black being often the prevailing tint; under-fur whitish, sometimes almost pure white, with the middle brown zone of the other forms obsolete; under parts (excepting the pectoral region) and the feet pure white; general color of the ears black, washed more or less with whitish, and with a very broad conspicuous white border.

In different specimens, the color of the dorsal aspect in summer varies

from pale yellowish-gray to yellowish-brown, varied with black. The hairs have a very long black tip, with a narrow subterminal bar of yellowish-brown, of varying intensity; thence to the base black. The effect of the long black tips is to give a much greater prevalence of black over the other tints than is seen in the other forms of *americanus*, imparting a general sooty tint to the whole upper surface. In some specimens, the black is quite the prevailing tint, especially over the rump, which region, in some specimens, is wholly black, varied with white by the white under fur showing through the surface color. The feet are wholly white, and there are generally a few white hairs on the back—traces, doubtless, of the winter pelage. The anterior part of the body above and the head are more or less rufous, this tint being most developed on the upper surface of the head. The white under-fur (varying in different specimens from white to grayish-white) always shows through the surface color more or less, and is conspicuous on the slightest disarrangement of the pelage. In one specimen only (No. 11099, from Lewis Lake, Wyoming Territory) is there a very decided trace of the yellowish zone that terminates the under-fur in the other forms of *Lepus americanus*.

Typical examples in summer pelage of this peculiarly interesting form give the impression of its being thoroughly distinct from any other form of *americanus*; but comparison of a series of specimens from the original locality of *L. bairdi* with others from the Red River district reveals a decided tendency to intergradation between these forms. The most prominent distinctive features of var. *bairdi* in summer pelage are its pure white under-fur, the long black tips of the hairs, and the white feet, and in winter the tendency of the pelage to become pure white to the base. Some of the summer specimens from the Red River district and from Fort Rae (northern shore of Great Slave Lake) also have white feet, and the pale yellowish-gray of the back is also strongly varied with black, and the under-fur is simply dusky, without the fulvous termination. Again, occasional specimens of *bairdi* have the fulvous apical zone of the under-fur slightly developed. Var. *bairdi*, in its blackish-gray dorsal surface and white under-fur, bears a strong resemblance to summer specimens of *L. timidus* var. *arcticus*, from the Arctic coast; but the great disparity in size and the differences in the skulls forbid the supposition of any very close affinity between them.

The few measurements obtainable from the considerable series of skins before me (mostly in a very bad state) are presented in the following table. The length varies from 15.50 to 18.00 inches, but on one or two of the

labels the collector has written "Length 19 in." The length of the ears and hind feet fully equal the dimensions of these parts in the largest specimens of var. *virginianus*, and indicate var. *bairdi* as perhaps the largest form of the group. The ears also appear relatively longer than in any other form. The skulls of which measurements are given are limited to two specimens, both immature, they still retaining the last temporary molar.\*

This variety appears to be strictly an alpine form, inhabiting the snowy summits of the higher portions of the Rocky Mountains. The specimens in summer pelage are, with one exception, all from the Wind River Mountains and other ranges near the head of the Yellowstone River, one being from the mountains of Colorado. Others, in winter pelage, are from the mountains west of Fort Benton, and from the Bitter Root Mountains near Fort Bridger, one also coming from as far south as Cantonment Burgwyn, New Mexico. I was informed by hunters and mountaineers, while west in 1871, of the occurrence of a white hare with very large broad feet in the Snowy Range of Colorado, in the Medicine Bow Mountains of Wyoming Territory, and in the Wasatch Mountains of Utah, which I doubt not is referable to this variety. The hunters spoke of it as being peculiar to the snowy region, and as very different from the white Hare of the plains (*Lepus campestris*), or from any other species with which they were acquainted, in the great breadth of its heavily-furred feet.

TABLE XV.—Measurements of *LEPUS AMERICANUS* var. *AMERICANUS*.

Catalogue-number.	Locality.	Sex.	From tip of nose to—				Tail to end of—		Length of—		Height of ear.	Nature of specimen.
			Eyes.	Ear.	Occip.	Tail.	Verteb.	Hair.	Fore foot.	Hind foot.		
6965	Yukon River, mouth of Porcupine....	♂	1.90	3.25	3.50	16.25	2.00†	4.90†	3.00	5.25	3.00	Fresh.
6968	.....do.....	♂	2.00	.....	3.50	17.10	2.00	3.80	.....	.....	.....	.....do.....
8996	Nulato, Yukon River.....	♂	.....	.....	.....	.....	.....	.....	2.35	5.25	2.75	Skin.
4444	Fort Simpson.....	.....	.....	.....	.....	.....	.....	.....	2.18	5.10	2.55	.....do.....
4459	.....do.....	.....	.....	.....	3.40	15.44	1.40	3.90	2.25	4.70	2.75	Fresh.
4430	Fort Liard.....	♀	1.55	2.90	.....	15.50	.....	.....	2.25	5.15	2.70	Skin.
4434	.....do.....	.....	1.50	3.75	.....	16.60	.....	.....	2.90	5.10	2.55	.....do.....
4435	.....do.....	♀	.....	.....	.....	16.25	.....	.....	2.35	5.90	2.65	.....do.....
4436	.....do.....	.....	.....	.....	.....	.....	.....	.....	2.50	5.25	.....	.....do.....
4437	.....do.....	♂	.....	.....	.....	15.25	.....	.....	2.45	5.90	2.90	.....do.....
3213	R. River Settlement.....	.....	.....	.....	.....	.....	.....	.....	2.35	5.15	2.90	.....do.....
3901	.....do.....	.....	.....	.....	.....	.....	.....	.....	2.45	4.75	2.25	.....do.....
4428	Merthy Portage.....	♀	1.75	3.00	3.50	15.75	1.25	2.95	.....	.....	.....	Fresh.

\* Several other skulls came to hand later, but I find that, through inadvertence, no measurements of them were taken before they again passed out of my hands.

TABLE XVI.—Measurements of skulls of *LEPUS AMERICANUS* var. *AMERICANUS*.

Catalogue-number.	Corresponding number of skin.	Locality.	Sex.	Total length.	Greatest width.	Distance between orbits.	Nasal bone, length.	Nasal bone, width behind.	Nasal bone, width before.	Upper incisors from front to molars.	Upper incisors, from front to hinder margin of palate.	Upper incisors, width between external edges.	Upper molars, length taken to center.	Upper molars, distance between.	Lower jaw, length.	Lower jaw, height.	Remarks.
4313	4437	Fort Laramie	♂	3.15	1.38	.75	1.30	.67	.60	.94	1.25	.57	.57	.60	2.39	1.45	Labeled <i>L. campestris</i> .
4313	4437	do	♂	3.05	1.35	.63	1.30	.64	.57	.90	1.25	.57	.57	.60	2.35	1.43	do.
4314	4437	do	♂	3.05	1.37	.70	1.55	.64	.68	.94	1.25	.57	.60	.65	2.39	1.39	do.
4315	4437	do	♂	3.05	1.39	.60	1.36	.60	.59	.96	1.25	.57	.57	.65	2.15	1.38	Also marked <i>L. californicus</i> .
4316	4437	do	♂	3.05	1.39	.68	1.33	.60	.59	.96	1.25	.57	.57	.65	2.07	1.47	do.
4316	4437	do	♂	3.10	1.43	.67	1.37	.63	.54	.94	1.25	.57	.57	.65	2.39	1.55	do.
4317	4437	do	♂	3.07	1.45	.71	1.17	.64	.58	.85	1.25	.57	.57	.65	2.16	1.46	do.
4318	4437	do	♂	3.20	1.49	.65	1.30	.63	.60	.94	1.25	.57	.57	.65	2.16	1.60	do.
4319	4437	Pool River	♂	3.30	1.60	.65	1.30	.63	.60	.94	1.25	.57	.57	.65	2.17	1.56	do.
4320	4437	do	♂	3.00	1.47	.65	1.15	.60	.58	.94	1.25	.57	.57	.65	2.17	1.45	do.
4321	4437	do	♂	3.00	1.47	.64	1.25	.63	.54	.87	1.25	.57	.57	.65	2.12	1.45	do.
4322	4437	Fort Adams	♂	3.00	1.45	.68	1.10	.57	.58	.88	1.17	.55	.55	.58	2.30	1.60	Also marked <i>L. americanus</i> .
4323	4437	do	♂	3.10	1.50	.66	1.25	.57	.58	.88	1.17	.55	.55	.58	2.30	1.60	do.
4324	4437	do	♂	3.10	1.50	.66	1.25	.57	.58	.88	1.17	.55	.55	.58	2.30	1.60	do.
4325	4437	do	♂	3.10	1.50	.66	1.25	.57	.58	.88	1.17	.55	.55	.58	2.30	1.60	do.
4326	4437	Fort Simpson	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	Also marked <i>L. americanus</i> .
4327	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4328	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4329	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4330	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4331	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4332	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4333	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4334	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4335	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4336	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4337	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4338	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4339	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4340	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4341	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4342	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4343	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4344	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4345	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4346	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4347	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4348	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4349	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4350	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4351	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4352	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4353	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4354	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4355	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4356	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4357	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4358	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4359	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4360	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4361	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4362	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4363	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4364	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4365	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4366	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4367	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4368	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4369	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4370	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4371	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4372	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4373	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4374	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4375	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4376	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4377	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4378	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4379	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4380	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4381	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4382	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4383	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4384	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4385	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4386	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4387	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4388	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4389	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4390	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4391	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4392	4437	do	♂	3.07	1.45	.68	1.05	.60	.56	.87	1.21	.57	.57	.60	2.30	1.63	do.
4393	4437																

TABLE XVII.—List of specimens of *LEPUS AMERICANUS* var. *AMERICANUS*.\*

Catalogue-number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.	Remarks.
8996	7579	564	♂	Nulato, Alaska...	Jan. 27, 1867	Intern. Tel. Exped.	W. H. Dall...	Skin and skull.	
8998	7580	567	...	do	Jan. 27, 1867	do	do	do	
8999	...	586	♂	do	Jan. 27, 1867	do	do	Skin	
8965	...	1019	♂	Yukon R., mouth of Peromphane.	Nov. 18, 1860	R. Kennicott...	R. Kennicott...	do	
8966	...	1047	♂	do	Mar. 15, 1861	do	do	do	
8967	...	1048	♂	do	Mar. 16, 1861	do	do	do	
8968	...	1025	♂	do	Jan. —, 1861	do	do	do	
...	6109	...	...	do	do	do	do	Skull	
...	6110	...	...	do	do	do	do	do	
...	6113	...	...	do	do	do	do	do	
...	6112	...	...	do	do	do	do	do	
...	6229	261	♂	Fort Yukon...	Jan. 30, 1863	J. Lockhart...	J. Lockhart...	do	
...	6111	...	...	Peel River	...	...	...	do	
...	6240	...	♂	do	...	...	...	do	
...	6241	...	♀	do	...	...	...	do	
...	6242	...	♂	do	...	...	...	do	
...	6243	...	♀	do	...	...	...	do	
1490	...	...	♂	Fort Anderson	Mar. —, 1864	R. McFarlane	R. McFarlane	Skin	
...	6253	...	♂	do	...	...	...	Skull	
...	6254	...	♂	do	...	...	...	do	
8108	...	377	♂	do	June 20, 1862	...	...	Skin	Very young.
9001	7554	733	...	do	...	R. Kennicott...	R. Kennicott...	...	
7557	...	598	...	do	...	...	...	do	
7558	...	597	...	do	...	...	...	do	
7559	...	599	...	do	...	...	...	do	
7560	...	530	...	do	...	...	...	do	
7561	...	531	...	do	...	...	...	do	
7562	...	532	...	do	...	...	...	do	
...	7563	533	...	do	...	...	...	Skull	
...	7564	534	...	do	...	...	...	do	
...	7565	535	...	do	...	...	...	do	
...	4314	...	...	Fort Liard	...	...	...	do	
...	4321	11	...	do	...	...	...	do	
...	4325	12	...	do	...	...	...	do	
...	4326	13	...	do	...	...	...	do	
...	4327	14	...	do	...	...	...	do	
4430	...	332	♀	do	...	...	...	Skin and skull.	
4431	4516	329	...	do	...	...	...	Skin	
4432	...	309	...	do	...	...	...	do	
4433	...	346	♀	do	...	...	...	do	
4434	...	338	...	do	...	...	...	do	
4435	4531	341	♀	do	...	...	...	Skin and skull	
4436	4515	314	...	do	...	...	...	do	
4437	4519	361	♂	do	Summer	...	...	do	
4425	...	...	♂	do	Summer	B. R. Ross	A. McKensie	Skin	Very young.
5078	...	...	...	Fort Rae	...	L. Clarke, Jr.	...	do	Very young.
6963	...	1399	♂	Fort Resolution	...	...	...	do	
...	6114	...	...	La Pierre's House	...	...	...	Skull	
...	1115	...	...	do	...	...	...	do	
...	1116	...	...	do	...	...	...	do	

\* All the skulls of this list had been labeled at the Smithsonian Institution *L. campestris*.

TABLE XVII.—List of specimens of *LEPUS AMERICANUS* var. *AMERICANUS*—Continued.

Catalogue number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.	Remarks.
4322	379	.....	.....	Fort Simpson	Dec. 6, 1890	R. Kennicott	R. Kennicott	do	
4317	378	.....	♀	do	Dec. 6, 1890	do	do	do	
4444	4319	.....	do	do	Dec. 6, 1890	do	do	Skin and skull.	
4441	4320	.....	do	do	Nov. 8, 1890	do	do	do	
4311	373	.....	do	do	Nov. 8, 1890	do	do	Skull	
4443	4328	.....	♂	do	Nov. 8, 1890	do	do	Skin and skull.	
4425	4329	.....	do	do	do	do	do	do	
4445	4330	.....	♂	do	Dec. 6, 1890	do	do	do	
4459	.....	5	.....	do	Mar. —, 1890	B. R. Ross	A. McKenzie	Skin	
4446	4323	.....	do	do	do	R. Kennicott	R. Kennicott	Skin and skull	
4447	4324	.....	do	do	do	do	do	do	
4448	4312a	.....	do	do	do	do	do	do	
7566	536	.....	do	do	do	do	do	Skull	
7567	537	.....	do	do	do	do	do	do	
7568	538	.....	do	do	do	do	do	do	
7569	539	.....	do	do	do	do	do	do	
7570	540	.....	do	do	do	do	do	do	
7571	541	.....	do	do	do	do	do	do	
7572	542	.....	do	do	do	do	do	do	
7573	543	.....	do	do	do	do	do	do	
7574	544	.....	do	do	do	do	do	do	
7575	545	.....	do	do	do	do	do	do	
7576	546	.....	do	do	do	do	do	do	
7581	716	.....	do	do	do	do	do	do	
7582	715	.....	do	do	do	do	do	do	
7583	714	.....	do	do	do	do	do	do	
7585	709	.....	do	do	do	do	do	do	
7586	708	.....	do	do	do	do	do	do	
7587	705	.....	do	do	do	do	do	do	
7588	707	.....	do	do	do	do	do	do	
7589	708	.....	do	do	do	do	do	do	
7590	772	.....	do	do	do	do	do	do	
7591	770	.....	do	do	do	do	do	do	
7592	771	.....	do	do	do	do	do	do	
7593	774	.....	do	do	do	do	do	do	
7594	773	.....	do	do	do	do	do	do	
4161	.....	.....	.....	Moose Factory, H. B. T.	.....	J. McKenzie	J. McKenzie	Skin	Black.
6208	.....	.....	.....	Bainy Lake, H. B. T.	.....	Wm. Mactavish	Wm. Mactavish	do	
4427	11	.....	♀	Dog Lake	Summer	R. Kennicott	R. Kennicott	do	
4428	90	.....	♀	Merthy Portage	July 27, —	do	do	do	
3424	.....	.....	○	do	July 27, —	do	do	do	
4423	4333	.....	♀	do	July 27, —	do	do	Skin and skull.	
4425	92	.....	○	do	July 27, —	do	do	Skin	
4429	4332	.....	.....	do	July 27, —	do	do	Skin and skull.	
3901	.....	.....	.....	Selkirk Settlement	.....	do	do	Skin	
3902	.....	.....	♂	do	.....	do	do	do	
3903	.....	.....	do	do	.....	do	do	do	
3915	.....	.....	do	do	.....	do	do	do	
3919	.....	.....	do	do	.....	do	do	do	
4022	.....	.....	do	Red River Settlement.	.....	do	do	do	



TABLE XVIII.—Measurements of *LEPUS AMERICANUS* var. *VIRGINIANUS*.

Catalogue number.	Locality.	Sex.	From tip of nose to—				Tail to end of—		Length of—		Height of ear.	Nature of specimen.
			Eye.	Ear.	Occip.	Tail.	Verteb.	Hairs.	Fore foot.	Hind foot.		
3507	Massachusetts .....	♂	1.80	3.40	4.90	20.00	1.40	2.50	2.35	5.35	2.85	Skin.
1507	do .....		1.75	3.35	4.15	17.50	1.40	2.30	2.55	5.45	2.80	do.
1512	do .....		1.75	3.30	4.25	17.75			2.25	5.10	3.00	do.
1514	do .....		1.80	3.50	4.60	17.50	1.55	2.30	2.55	5.50	3.60	do.
1516	do .....		1.75	3.10	4.10	17.50	0.85	2.00	2.45	5.30	2.90	do.
1517	do .....		1.85	3.25	4.00	17.50	0.85	1.50	2.40	5.15	2.90	do.
1518	do .....		1.75	3.25	4.30	17.00			2.35	5.35		do.
1511	do .....		1.75	3.20	4.20	17.00			2.55	5.50	2.80	do.
1515	do .....		1.70	3.20	4.15	16.75	1.40	2.30	2.60	5.50	2.95	do.
1510	do .....			3.15	3.85	16.75			2.90	5.15	2.75	do.
1506	do .....		1.75	3.25	3.85	16.00	1.00	2.15	2.45	5.10	2.40	do.
1513	do .....		1.50	3.00	3.75	15.25	0.85	1.60	2.15	4.65	2.40	do.
1509	do .....		1.60	3.20	3.80	14.75	0.90	2.15	2.35	5.00	3.00	do.
1508	do .....		1.50	3.00	4.00	14.00			2.50	5.20	2.60	do.
1073	Middleborough, Mass .....	♂			3.75	21.00			2.25	5.15	3.35	Skin. From Baird.
1430	do .....	♂				20.00			2.45	5.10		do.
1074	do .....					18.50			2.32	4.85	3.15	do.
959	do .....	♂				18.50			2.41	5.20	3.15	do.
1075	do .....					17.50				4.57	3.16	do.
1076	do .....				3.15	17.50				4.98	3.05	do.
960	do .....	♂			3.25	17.00	1.33	2.23		5.46	3.30	do.
552	New York State .....					21.00				3.30	3.60	do.
551	do .....	♀	2.00	3.50	4.00	19.50	1.33	2.22		5.38	3.40	do.
849	do .....					18.00				5.63	3.60	do.
481	do .....				7.60	18.00	1.15	2.25		5.68	3.38	do.
67	Northern Pennsylvania .....				4.37	22.00	1.00	1.75	2.55	5.50	3.40	do.
66	do .....				4.18	19.00					3.40	do.
317	do .....		1.58	3.00	3.25	16.00	1.33	1.75	2.58	4.84	3.42	Fresh. From Baird.
316	New York State .....		1.66	3.17	3.50	19.50	1.58	2.42	2.50	5.50	3.58	do.
250	Quebec, Canada .....			3.33	4.00	20.00	1.50	2.25		5.50	3.00	Skin. From Baird.

TABLE XIX.—Measurements of skulls of *LEPUS AMERICANUS* var. *VIRGINIANUS*.

Catalogue-number.	Original number.	Locality.	Sex.	Total length.	Greatest width.	Distance between orbits.	Nasal bones, length.	Nasal bones, width behind.	Nasal bones, width before.	Upper incisors from front to molars.	Upper incisors from front to hinder margin of palate.	Upper incisors, height.	Upper incisors, width between external edges.	Upper molars, length taken together.	Upper molars, distance between.	Lower jaw, length.	Lower jaw, height.	Remarks.
9004	980	Middleboro', Mass.	♂	3.15	1.00	0.70	1.23	0.65	0.64	1.00	1.23	0.37	0.30	0.65	0.48	2.25	1.47	
9003	959	do	♂	3.94	1.52	0.70	1.32	0.68	0.70	0.97	1.27	0.40	0.38	0.58	0.50	2.25	1.50	
1236	316	New York	♂	3.10	1.55	0.64	1.25	0.66	0.58	0.94	1.30	0.36	0.27	0.57	0.50	2.20	1.50	
1237	317	do	♂	2.75	1.40	0.63	1.08	0.65	0.50	0.85	1.12	0.31	0.25	0.42	0.45	1.90	1.32	(Immature); no
1673	551	do	♂	3.30	1.62	0.76	1.37	0.70	0.68	1.00	1.35	0.37	0.30	0.63	0.52	2.30	1.55	lars ♀.
3910	.....	do	♂	3.35	1.60	0.66	1.40	0.65	0.54	1.00	1.35	0.34	0.35	0.58	0.47	2.35	1.60	
1665	481	do	♂	3.25	1.67	0.70	1.32	0.66	0.62	1.05	1.32	0.35	0.29	0.60	0.50	2.35	1.60	
302	.....	Upton, Oxford County, Me.	♂	3.05	1.02	0.57	1.02	0.60	0.54	0.93	1.27	0.35	0.25	0.55	0.45	2.17	1.45	
306	.....	do	♂	3.05	1.50	0.61	1.25	0.67	0.50	0.93	1.23	0.38	0.25	0.53	0.43	2.10	1.37	
305	.....	do	♂	3.30	1.66	0.66	1.45	0.74	0.62	1.00	1.27	0.38	0.27	0.60	0.50	2.45	1.63	
306	.....	do	♂	2.90	1.50	0.57	1.20	0.62	0.54	0.92	1.20	0.33	0.25	0.55	0.47	2.05	1.37	
307	.....	do	♂	3.10	1.35	0.61	1.27	0.70	0.54	1.04	1.23	0.38	0.25	0.57	0.50	2.20	1.43	
308	.....	do	♂	3.10	1.53	0.60	1.25	0.56	0.54	0.92	1.23	0.38	0.27	0.60	0.47	2.12	1.43	
310	.....	do	♂	2.80	1.40	0.55	1.15	0.60	0.50	0.87	1.20	0.28	0.26	0.54	0.40	2.05	1.25	
311	.....	do	♀	3.10	1.52	0.65	1.04	0.65	0.60	0.95	1.25	0.28	0.28	0.62	0.45	2.15	1.47	
312	.....	do	♀	3.05	1.57	0.65	1.04	0.67	0.50	0.93	1.25	0.30	0.27	0.57	0.45	2.10	1.40	
313	.....	do	♀	3.10	1.55	0.67	1.30	0.65	0.62	0.98	1.25	0.32	0.27	0.58	0.50	2.11	1.45	
319	.....	do	♀	3.16	1.55	0.72	1.04	0.65	0.54	1.00	1.23	0.30	0.28	0.60	0.52	2.21	1.45	
320	.....	do	♂	3.20	1.60	0.70	1.25	0.65	0.58	1.03	1.28	0.37	0.30	0.58	0.54	2.20	1.60	
321	.....	do	♂	3.05	1.52	0.65	1.30	0.65	0.54	0.98	1.30	0.35	0.25	0.57	0.47	2.05	1.45	
304	.....	do	♂	3.06	1.55	0.65	1.28	0.65	0.50	1.00	1.30	0.30	0.24	0.58	0.47	2.05	1.50	

TABLE XX.—List of specimens of *LEPUS AMERICANUS* var. *VIRGINIANUS*.

Catalogue-number.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
*1506				Massachusetts	Winter	L. Agassiz		Skin.
*1507				do	do	do		do.
*1508				do	do	do		do.
*1509				do	do	do		do.
*1510				do	do	do		do.
*1511				do	do	do		do.
*1512				do	do	do		do.
*1513				do	do	do		do.
*1514				do	do	do		do.
*1515				do	do	do		do.
*1516				do	Fall	do		do.
*1517				do	do	do		do.
*1518				do	Winter	do		do.
*1519				do	Fall	do		do.
*9607				do	Winter		C. J. Maynard	do.
*2825				do	Fall		do	do.
*2534		175	♀	do	do		do	do.
*2533				do	Summer	L. Agassiz		do.
1505		0		Lake Superior	do	do		do.
250	1302			Quebec, Canada	Aug. —, 1853	S. F. Baird	S. F. Baird	Skin and skull.
1440		♂		Middleborough, Mass	Mar. 7, 1856	J. W. P. Jenks	J. W. P. Jenks	Skin.
1073				do	Nov. 30, 1855	do	do	do.
1076				do	Nov. 30, 1855	do	do	do.
959	2003	♂		do	Oct. 23, 1855	do	do	Skin and skull.
960	2004			do	Oct. 17, 1855	do	do	do.
8143				Massachusetts	Summer	Boston Society of Natural History.		Skin.
8144				do	do	do		do.
920				Essex County, N. Y.	Winter	S. E. Hale	S. E. Hale	do.
11067				New York State	do	J. G. Bell	Market	do.
551	1670	♀		Essex County, N. Y.	do	S. F. Baird	do	Skin and skull.
318	1236			do	Dec. 1, 1854	do	do	do.
481	1289			do	Feb. 2, 1855	do	do	do.
	1605			do	Feb. 2, 1855	do	do	do.
863	1915	0 ♀		do	Oct. 6, 1855	S. F. Baird	Market	Skin and skull.
849	1906			do	Sept. 6, 1855	do	do	do.
1569	2399			do	Winter	S. E. Hale	S. E. Hale	do.
1578	2400			do	do	do	do	do.
	3910			New York State	do	S. F. Baird	Market	Skull.
	3827			do	do	do	do	do.
317	1237			Northern Pennsylvania	Dec. —, 1854	do	do	Skin and skull.
66	969			do	Winter, 1855	do	do	do.
	970			do	do	do	do	Skull.
1175				Alleghany County, Md.	Winter	Dr. J. L. M. Comas	Dr. J. L. M. Comas	Skin.

\* Specimens from Museum of Comparative Zoology, Cambridge, Mass.

TABLE XXI.—Measurements of *LEPUS AMERICANUS* var. WASHINGTONI.

Catalogue-number.	Locality.	From tip of nose to—			Tail to end of—		Length of—		Height of ear.	Nature of specimen.
		Ear.	Occip.	Tail.	Verteb.	Hairs.	Fore foot.	Hind foot.		
390	Stellacoom, Wash. ....	.....	3.43	18.50	0.66	1.50	.....	4.43	3.25	Skin. From Baird.
3908	.....do. ....	.....	.....	18.00	.....	.....	.....	4.30	.....	.....do.
303	Shoalwater Bay, Wash. ....	1.75	3.00	16.00	0.84	1.75	1.90	4.13	.....	.....do.
5881	Washington Territory .....	.....	.....	17.25	.....	.....	2.50	5.30	3.10	.....do.
5883	.....do. ....	.....	.....	16.25	.....	.....	2.50	5.00	3.15	.....do.
5884	.....do. ....	.....	.....	16.00	.....	.....	2.35	4.75	3.00	.....do.
5886	.....do. ....	.....	.....	.....	.....	.....	2.40	5.00	.....	.....do.
5887	.....do. ....	.....	.....	.....	.....	.....	2.30	5.25	3.05	.....do.
3914	Chilowaynek Depot, Wash. ....	.....	.....	15.25	.....	.....	2.35	4.50	2.90	.....do.
3917	.....do. ....	.....	.....	16.25	.....	.....	2.30	4.90	2.60	.....do.

TABLE XXII.—Measurements of skulls of *LEPUS AMERICANUS* var. WASHINGTONI.\*

Catalogue-number of skull.	Corresponding number of skin.	Locality.	Total length.	Greatest width.	Distance between orbits.	Nasal bones, length.	Nasal bones, width behind.	Nasal bones, width before.	Upper incisors from front to molars.	Upper incisors from front to hinder margin of palate.	Upper incisors, height.	Upper incisors, width between external edges.	Upper molars, length taken together.	Upper molars, distance between.	Lower jaw, length.	Lower jaw, height.
9408	.....	Stellacoom, Wash. ....	2.87	1.50	0.65	1.15	0.65	0.52	0.90	1.18	0.27	0.32	0.52	0.40	2.00	1.49
6904	.....	Washington Territory ....	2.80	1.40	0.60	1.19	0.60	0.50	0.81	1.10	0.28	0.32	0.50	0.40	1.96	1.57
6905	.....	.....do. ....	2.96	1.49	0.65	1.28	0.64	0.52	0.95	1.20	0.32	0.36	0.55	0.45	2.00	1.37
6906	.....	.....do. ....	2.53	1.45	0.65	1.15	0.58	0.60	0.87	1.04	0.30	0.36	0.55	0.42	2.03	1.35
6908	.....	.....do. ....	2.90	1.43	0.65	1.15	0.58	0.52	0.85	1.19	0.33	0.35	0.55	0.45	1.99	1.37
3667	3917	Chilowaynek Depot, Wash. ....	3.10	1.46	0.65	1.25	0.60	0.60	0.98	1.25	0.36	0.35	0.60	0.42	2.03	1.38

\* No. 3667 is the only aged specimen in the series; in the others, the sutures are still quite open.

TABLE XXIII.—List of specimens of *LEPUS AMERICANUS* cap. WASHINGTON.

Catalogue-number.	Corresponding number of.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.	Remarks.
8994		517		Kokoyonuk.		Inter. Teleg. Expedition	Captain Ketchum	Skin	Changing pelage.
8995		519		do		do	do	do	do
9000		514		do		do	do	do	do
9001		514		Washington Territory	Winter, 1881	A. Campbell	Dr. C. E. Kennery	do	
9002		410		do	do	do	do	do	
9003		413		do	do	do	do	do	
9004		415		do	do	do	do	do	
9005		412		do	Dec. 24, 1880	do	do	do	
9006		411		do	Winter	do	do	do	
9007		494		Shyakwatum Depot	Nov. 30, —	do	do	do	
9008		387		Chlomenah Depot	June —, 1889	do	do	do	
9009		388		do	do	do	do	do	
9010		389		Washington Territory	do	do	do	do	
9011		390		do	do	do	do	do	
9012		391		do	do	do	do	do	
9013		392		do	do	do	do	do	
9014		393		Shalvaker Bay, Wash.	do	do	do	do	
9015		394		Vancouver, Wash.	Feb. —, 1884	Gen. L. I. Stevens	Dr. J. G. Cooper	do	
9016		395		Fort Steilacoon, Wash.	Apr. 1, 1884	Dr. George Suckley	Mr. G. Gibbs	do	
9017		396		do	do	do	Dr. G. Suckley	do	
9018		397		Coe Creek, Wash.	Nov. —, 1884	Dr. George Suckley	do	do	
9019		398		do	June —, 1880	A. Campbell	Dr. C. E. Kennery	Skin	
9020		399		Moerle Cacho, Wash.	Summer	do	do	do	Very young
9021		400		do	do	do	do	do	do
9022		401		Camp Steilacoon, Wash.	Summer, 1880	do	Dr. C. E. Kennery	do	do
9023		402		Head of Willamette	do	Lieut. E. S. Williamson	Dr. J. S. Newberry	Skin and skull.	do
9024		403		Cascade Mountains, Oregon Territory	Summer	U. S. S. Fr. Expl.	Dr. W. Simpson	Skin	do

TABLE XXIV.—Measurements of *LEPUS AMERICANUS* var. BAIRDI.

Catalogue-number.	Locality.	Sex.	From tip of nose to—					Tail to end of—		Length of—		Nature of specimen.
			Eye.	Ear.	Occip.	Tail.	Verteb.	Hairs.	Fore foot.	Hind foot.	Height of ear.	
4982	Wind River Mountains.....	♂	1.43	3.37	.....	17.50	.....	.....	2.50	3.35	3.90	Fresh.
4983	.....do.....	.....	1.75	3.50	.....	18.00	.....	.....	2.60	3.40	3.60	...do.
4984	.....do.....	.....	.....	.....	.....	.....	.....	.....	2.70	3.50	2.85	Skin.
11503	Colorado.....	.....	1.60	2.90	3.60	17.25	1.45	2.25	2.25	3.55	3.00	...do.
11008	Shoshone Lake.....	.....	.....	.....	.....	.....	.....	.....	2.75	3.35	.....	...do.
3093	Fort Bridger.....	.....	.....	.....	.....	17.75	.....	.....	2.00	3.75	2.95	...do.
3098	.....do.....	.....	.....	.....	.....	16.00	.....	.....	2.25	4.00	2.90	...do.
4170	West of Fort Denton.....	.....	.....	.....	.....	15.50	.....	.....	2.40	4.00	3.25	...do.

TABLE XXV.—Measurements of skulls of *LEPUS AMERICANUS* var. BAIRDI.

Catalogue-number.	Locality.	Total length.	Greatest width.	Distance between orbits.	Zygomatic bones, length.	Zygomatic bones, width behind.	Zygomatic bones, width before.	Upper incisors from front to molars.	Upper incisors from front to hinder margin of palate.	Upper incisors, height.	Upper incisors, width between external edges.	Upper molars, length taken together.	Upper molars, distance between.	Lower jaw, length.	Lower jaw, height.	Remarks.
3291	Medicine Bow Mountains.	3.65	1.50	0.54	.....	0.57	.....	0.76	1.03	0.35	0.28	0.47	0.47	1.77	1.14	Immature; last temporary molar still in place. Skull marked <i>L. americanus</i> .
4186	Bitter Root Valley ....	2.77	1.51	0.65	1.10	0.64	0.50	0.86	1.18	0.32	0.34	0.50	0.40	1.88	1.28	.....do.



*General remarks on LEPUS AMERICANUS and its varieties.*

*Lepus americanus* differs from the other Varying Hares in its much smaller size and relatively shorter ears, as well as in the size and proportions of the skull. Aside from its white winter pelage, it also differs much from all the other Hares of this continent in color, proportions, and in cranial characters, and from most of them, moreover, in size.

Of its four geographical varieties (*americanus*, *virginianus*, *washingtoni*, and *bairdi*), var. *bairdi* seems to be the most strongly marked. Var. *americanus* is the northern form, with a softer and longer winter pelage, more heavily-clothed ears and feet, with the white of the surface invading the pelage to a considerable depth, and with a duskier, duller-tinted summer pelage. By gradual stages, however, it shades into var. *virginianus*, its southern representative on the Atlantic coast, which has the whiteness of the winter pelage restricted to the surface, only partially concealing the color of the under fur, and in which the summer pelage is of a brighter or redder tint. Var. *washingtoni* is the southern Pacific coast form, known at present only from the region about Puget's Sound. In summer pelage, it is rather more rufous even than var. *virginianus*, but by no differences as yet discovered is it always distinguishable from the latter form. Like *virginianus*, it is a southern representative of *americanus*, with which it insensibly intergrades. Var. *bairdi* occupies an intermediate geographical position, and may be regarded as an alpine form. Its distinguishing features are in the summer pelage the prevalence of black, the white under-fur, and white feet, and in winter the tendency to an entire whiteness of the under-fur. It shows, however, decided intergradations with the northern form, as well as with the two southern forms, with which it essentially agrees in size and proportions. So far as at present known, there is no very marked variation in size with locality throughout the wide region inhabited by the varieties of *L. americanus*.

GEOGRAPHICAL DISTRIBUTION.—*Lepus americanus*, in some of its forms, occupies the wooded portion of the whole northern half of the continent, extending southward in the Rocky Mountains as far, at least, as New Mexico; its southern limit of distribution coinciding very nearly, apparently, with the isotherm of 50°. On the Pacific coast, the species is represented in var. *washingtoni* as far south as the head of the Willamette River; in the interior,



through var. *bairdi*, it extends throughout the higher parts of the Rocky Mountains south, at least to Cantonment Burgwyn, New Mexico; to the eastward of the Missouri River, as var. *virginianus*, it occurs in Minnesota, and thence eastward throughout the northern parts at least of nearly all the northern tier of States, and in the Alleghanies southward, at least to Virginia, and on the Atlantic coast to Connecticut. Its limit in the Eastern States hence nearly coincides with that of the Alleghanian fauna. To the northward, it ranges to the limit of trees, extending even to the very borders of the Arctic Barren Grounds.

The range of the several varieties is not so easily indicated. Var. *americanus* seems to remain well-defined as that type southward to New Brunswick and Nova Scotia on the Atlantic coast, and as far as the Red River Settlements in the interior. Var. *bairdi*, occupying the higher parts of the Rocky Mountains, separates the two southern forms, *virginianus* and *washingtoni*, and doubtless extends a long way northward into the habitat of var. *americanus*. Var. *americanus* is the form received from Southern Alaska; but its southern limit on the Pacific coast is not as yet known. Var. *washingtoni*, however, has been received from as high as about latitude 55°. So far as our present knowledge goes, we may define the habitat of var. *virginianus* as occupying the Atlantic coast-region from Nova Scotia to Connecticut; the whole of the higher parts of the Apalachian Highlands as far south as Virginia, and probably to North Carolina; in the interior, the northern half of the northern tier of States, and the southern half of the Canadas, westward to the highlands bordering the northern shore of Lake Superior, where here and in Northern Minnesota it doubtless gradually merges into variety *americanus*.

SYNONYMY.—We find allusions to the *Lepus americanus* auct. in the writings of several of the early authors, among whom is Kalm, who refers to it briefly in his Travels (vol. iii, p. 59, English ed.), and supposed it to be identical with the Varying Hare of Europe. The first specimens reached England in 1771, and were described in the Philosophical Transactions (vol. lxii, p. 4) by Daines Barrington in 1772 under the name of the "Hudson's Bay Quadruped". In the same volume, it is again more fully described by J. R. Forster, who gives also some account of its habits, but, in so doing, quotes Kalm's reference to quite a different species (the *L. sylvaticus* Bach.) inhabiting New Jersey. Pennant, in his History of Quadrupeds (in 1784),

while quite accurately describing the animal, confounds it with other species; for, in speaking of its distribution and habits, he quotes not only Kalm's reference to the *L. sylvaticus*, but also Lawson's account of the Rabbit of Carolina. Erxleben, in 1777, based his *L. americanus* on Kalm (his reference to the Hare of Hudson's Bay, not the southern Gray Rabbit), Barrington, and Forster, and his diagnosis is in every respect applicable to this species, and to this alone. Gmelin's account is abridged from that of Erxleben, he citing the same authors. Shaw, and some other later writers, continued to confound it with other species, giving as its habitat the whole of North America. Pallas, in 1778, described it under the name of *Lepus hudsonius*, and Schreber, in 1792, as *Lepus nanus*. While Schreber's diagnosis refers exclusively to *L. americanus*, he blended its general history with that of *L. sylvaticus*. Desmarest, in 1822, rather increased the confusion already existing by giving a description referring mainly to *L. sylvaticus* under the name of *L. americanus*. In his references, he cites not only Erxleben and Pallas, whose descriptions refer exclusively to *L. americanus*, but also Schoepf, whose description of "Der Nord-Amerikanische Haase" as exclusively refers to *L. sylvaticus*, while he gives its habitat as including not only the region west of Hudson's Bay, but also the Carolinas, Florida, Louisiana, California, and Mexico. From this time, however, till 1842, the name *americanus* was often applied, even by American writers, to the *L. sylvaticus*, it being thus used by Harlan in 1825, and later by Fischer, Audubon, Emmons, Thompson, and others. Harlan still further increased the confusion by redescribing the *L. americanus* under the name of *L. virginianus*, supposing it to be a new species; while Dr. Godman, in 1826, considered it as identical with the *L. variabilis* of Europe. The mistakes of Desmarest and Harlan were repeated even by Dr. Bachman in his first paper on the American Hares, published in 1837. In the mean time, however, Dr. Richardson (in 1829) had re-instated Erxleben's name of *L. americanus*, and Dr. Bachman, in a supplemental note to his paper, rectified his former error. In 1839, in a second paper on the American Hares, Dr. Bachman refers to this species under its proper name; and, in 1849, in the first volume of the Quadrupeds of North America, fully elucidates its synonymy, giving Erxleben's description in full. Since the date of Dr. Bachman's second paper, the species has been generally recognized by its proper designation. I find, however, that all the skulls of this species, in the Museum of the Smithsonian Institution, from the Hudson's Bay Territories, are marked

*L. "campestris"*. Some of them, however, bear the partially-erased name *L. "americanus"* of a prior determination. The skins, however, of these same specimens, are still labeled *L. "americanus"* or *L. "americanus?"* whenever a specific name is added, some being labeled simply "*Lepus*". The *L. "campestris"* of Hayden, referred to in his description of *L. bairdi*, belongs to this northern form, as does also the *L. "campestris Bachman"* of Dall, given in his nominal list of the Mammals of Alaska, as shown by his specimens still in the collection of the Smithsonian Institution.

Respecting this application of the name *campestris*, Professor Baird writes me (under date of March 31, 1874) that he was "still not convinced that the *Lepus virginianus* of Richardson refers to the Townsend's Hares of the Upper Missouri. The specimens described by Richardson", he continues, "are of course too imperfect to permit any satisfactory description; and the dimensions given are probably too large. It is entirely out of the question for Richardson to have overlooked the occurrence of the northern variety of *Lepus americanus*, as it is found everywhere, from Fort Garry northward, is very common on the Saskatchewan, and constitutes a large portion of the food of the Indians in the regions traversed by him. It is particularly abundant about latitude 55°. In the many collections that we have had from the Hudson's Bay Territory, you will note the entire absence of any Hares resembling the *townsendi*. If my supposition be correct, then, if you give a name to the grayish northern form of the American Hare, that should be *campestris*, and Townsend's name be retained for the big Missouri River species."

As already noticed under the head of *Lepus campestris*, I consider Richardson's *L. virginianus* (subsequently named *campestris* by Bachman) to refer beyond question to the long-limbed, long-eared, and long-tailed Townsend Hares of the Upper Missouri, and can see no reason for presuming the measurements given as "probably too large". Bachman certainly understood his name to apply to a long-eared, long-tailed Hare so like what he later named *L. townsendi* that he repeatedly states his conviction that they would prove to be the same, he having been at first erroneously informed that the *L. townsendi* never became white. As to Richardson overlooking "the northern form of *Lepus americanus*", he certainly did not do so, as he has described it in detail under that name, and especially refers to its importance to the Indians as an article of food, and their method of capturing this animal. Furthermore, he distinguishes the *L. virginianus* as a prairie species, while

his *L. americanus* is not found in such places, but inhabits thick woods. He says particularly that "on the barren grounds to the eastward of the Coppermine, and on the extensive plains or prairies through which the Missouri and Saskatchewan flow, it is replaced by other and larger species"—respectively his *L. glacialis* and *L. virginianus*. Furthermore, his description of the summer pelage of his *L. americanus* corresponds perfectly with the specimens in the Smithsonian Institution from the Red River district northward to the Yukon. Several points in his description of *L. virginianus*, aside from its size, as the color of the under fur of the back, are wholly inapplicable to the *L. americanus*, but strictly accord with the characters of the Townsend's Hares.\*

The differences, as already noticed, between the northern and southern forms of *L. americanus* are quite appreciable, and, in giving them varietal designations, it becomes necessary to restrict the name *americanus* to the northern form, the earlier descriptions of *americanus* being based solely on specimens from Hudson's Bay, while Harlan's name of *virginianus* is alone applicable to the southern form, his description being based on Virginian specimens. As already noticed, the Nova Scotia and Red River specimens belong to the northern type, the southern form being mainly if not wholly restricted to the northern parts of the United States east of the Missouri River.

*Lepus washingtoni* was first described by Professor Baird in 1855, and *Lepus bairdi* by Dr. Hayden in 1869, and neither of them have been confounded with either of the other varieties of *Lepus americanus* or with any other species.

#### LEPUS SYLVATICUS Bachman.

Var. SYLVATICUS.

##### Wood Hare; "Gray Rabbit"; "Wood Rabbit."

*Lepus nanus* SCHREBER, Säuget., iv, 1793, 881 (in part only).—DEKAY, New York Zool., i, 1842, 93, pl. xxvii, fig. 1.—WAGNER, Suppl. Schreber's Säuget., iv, 1843, 114.

*Sylvilagus nanus* GRAY, Ann. and Mag. Nat. Hist., 3d ser., xx, 1867, 221.—ALLEN, Bull. Mus. Comp. Zool., i, 1869, 339.

*Lepus americanus* DESMAREST, Mammalogie, ii, 1822, 351.—HARLAN, Faun. Amer., 1825, 193.—AUDUBON, Birds of Amer., pl. 51.—FISCHER, Synop. Mam., 1829, 376 (in part only).—BACHMAN, Journ. Acad. Nat. Sci. Phil., vii, 1837, 336, pl. xvi, figs. 3, 4 (ear and foot).—EMMONS, Quad. Mass., 1840, 58.—THOMPSON, Nat. Hist. Vermont, 1842, 48.

\* Since the above was written, Professor Baird has conceded the inapplicability of the name *L. campestris* to the smaller short-eared Varying Hare of British North America.

- Lepus sylvaticus* BACHMAN, Journ. Acad. Nat. Sci. Phila., vii, 1837, 403; viii, 1839, 78.—WATERHOUSE, Nat. Hist. Mam., ii, 1848, 116.—AUD. & BACH., Quad. N. Am., i, 1849, 173, pl. xxii.—WOODHOUSE, Sitgreaves's Col. and Zuni River Exp., 1853, 55 (Eastern Texas and Indian Territory).—MAXIMILIAN, Wiegman Arch., 1861, i, 144.—BAIRD, Mam. N. Am., 1857, 597, pl. viii, fig. 1 (skull); U. S. and Mex. Bound. Surv., ii, 1859, ii, 47 (Indianola, Texas).—HAYDEN, Trans. Am. Phil. Soc. Phila., xii, 1863, 148.—ABBOTT, Cook's Geol. of New Jersey, 1868, 759.—ALLEN, Proc. Bost. Soc. Nat. Hist., xliii, 1869, 194; Bull. Mus. Comp. Zool., ii, 1871, 184.
- Lepus bachmani* WATERHOUSE, Proc. Zool. Soc. Lond., vi, 1838, 103; Nat. Hist. Mam., ii, 1848, 124.—BACHMAN, Journ. Acad. Nat. Sci. Phila., viii, 1839, 96.—AUD. & BACH., Quad. N. Am., iii, 1853, 36, pl. cviii (based on Waterhouse's specimens).—BAIRD, Mam. N. Am., 1857, 606; U. S. and Mex. Bound. Survey, ii, 1859, ii, 48 (Brownsville, Texas).
- Sylvilagus bachmani* GRAY, Ann. and Mag. Nat. Hist., 3d series, xx, 1867, 222.

## Var. NUTTALLI.

## Sage Hare.

- Lepus nuttalli* BACHMAN, Journ. Acad. Nat. Sci. Phila., vii, 1837, 345, pl. xxii; viii, 1839, 79; Townsend's Narrative, 339, 329 (based on an immature specimen).—AUD. & BACH., Quad. N. Am., ii, 1851, 300, pl. xciv.—BAIRD, Mam. N. Am., 1857, 604, 617.
- Lepus sylvaticus* var. *nuttalli* ALLEN, Proc. Bost. Soc. Nat. Hist., xvii, 1875, 334.
- Lepus artemisia* BACHMAN, Journ. Acad. Nat. Sci. Phila., viii, 1839, 94; Townsend's Narrative, 1839, 329.—WATERHOUSE, Nat. Hist. Mam., ii, 1848, 126.—AUD. & BACH., Quad. N. Am., 1851, ii, 272, pl. lxxxviii.—WOODHOUSE, Sitgreaves's Col. and Zuni River Exp., 1853, 55.—BAIRD, Mam. N. Am., 1857, 602; U. S. and Mex. Bound. Survey, ii, 1859, ii, 48, pl. xxv, fig. 2 (skull).—NEWBERRY, Pacific R. R. Ex. and Surv., vi, iv, 1857, 65.—KENNERLY, ibid., x, vi, 1859, 16.—SUCKLEY, ibid., xii, iii, 1860, 105.—SUCKLEY & GIBBS, ibid., 132.—HAYDEN, Trans. Am. Phil. Soc. Phila., xii, 1863, 148.—COUES, Am. Nat., i, 1867, 534; Proc. Acad. Nat. Sci. Phila., 1867, 136.
- Sylvilagus artemisia* GRAY, Ann. and Mag. Nat. Hist., 3d ser., xi, 222.
- Lepus artemisiacus* WAGNER, Suppl. Schreber's Säuget., iv, 1844, 114.

## Var. AUDUBONI.

## Audubon's Hare.

- Lepus auduboni* BAIRD, Mam. N. Am., 1857, 606, pl. xiii (animal); pl. lviii, fig. 2 (skull).—NEWBERRY, Pacific R. R. Ex. & Surv., vi, iv, 1857, 66.—KENNERLY, Pacific R. R. Ex. & Surv., x, vi, 1859, 17 (markets of San Francisco).—GRAY, Ann. and Mag. Nat. Hist., 3d ser., xi, 1867, 224.
- Lepus sylvaticus* var. *auduboni* ALLEN, Proc. Bost. Soc. Nat. Hist., xvii, 1875, 434.

## Var. SYLVATICUS.

## Wood Hare.

Above pale yellowish-brown, varied with black; sides and rump grayer; nape and limbs yellowish-rusty, fading into whitish on the anterior surface of the hind legs; head above less varied with black than the back; beneath white, except the breast, which is pale yellowish-brown. The hairs of the upper surface have very long shining black tips, succeeded first by a broad bar of pale yellowish-brown, then by a rather narrower zone of black, and thence to the base grayish-plumbeous. Under-fur dark plumbeous, nearly black, often tipped with pale brown. Length (tip of nose to tail), 13.50 to 17.00 inches; of hind foot, 3.10 to 4.20; of ear, 2.10 to 3.00; ear about two-thirds the length of the head; head a little shorter than the hind foot.

Specimens from the same locality differ in color mainly in the amount of black presented by the dorsal surface, this depending upon the relative length of the black tips of the hairs. There is a slight variation also in respect to the intensity of the brown of the subterminal bar. The variation in color with the season is not very marked, consisting in winter specimens being somewhat grayer than summer specimens. Southern specimens are but little more strongly colored than northern ones, the rufous being of a rather stronger tint and the black more prevalent. Those from the States immediately west of the Mississippi River begin to be lighter than those from the Atlantic slope. Further westward, the paleness gradually increases till we reach the pale form of the arid plains. Specimens from northern localities, both on the Atlantic slope and in the interior, are sometimes wholly without the brownish termination of the under-fur, or it is only faintly developed, and confined mainly to the sides. Here it is generally, however, quite strong, and is frequently quite appreciable on the middle of the dorsal region. The same variation in this respect is seen both in Massachusetts and western specimens; Iowa examples being not distinguishable in this respect from New England ones. To the southward, however, the brownish terminal band of the under-fur becomes more uniformly traceable, being generally present in specimens from about Washington, but much stronger in those from South Carolina and Florida, in which it generally forms a strong broad bar, though sometimes obsolete.

The geographical variation in color is mainly as already noticed, namely, an increasing paleness from the Mississippi westward toward the Plains, where variety *sylvaticus* passes by insensible steps into variety *nuttalli* (= *artemisias* auct.). The specimens from Eastern Nebraska and Eastern Dakota can, in general, hardly be referable to the one form rather than to the other. At the southward, the colors become slightly more intense, but the difference is by no means striking. The variation in size with locality is quite appreciable, as shown in Tables XXVII and XXVIII, the largest specimens being from the north. Washington specimens are somewhat larger than those from South Carolina and Florida, while those from Massachusetts are again rather larger than those from Washington; those from Wisconsin and Iowa are fully as large as New England specimens, and very much larger than Texas ones. Passing further south, however, we find, contrary to what would be anticipated, that specimens from Southern Mexico are fully as large as those from

the northern parts of the United States, and more closely resemble them than do the specimens from Georgia and Florida. A series of twenty-one specimens from Southeastern Mexico and Yucatan (Orizaba, Tehuantepec, and Mirador, Mexico, and Merida, Yucatan) presents but slight differences from those from the Atlantic States. The difference consists chiefly in the rufous tinge being rather stronger in the Mexican specimens, which is seen especially in the brighter color of the legs and feet. Yet specimens from Tehuantepec and Orizaba can be almost exactly matched by specimens from the vicinity of Washington. The Mexican specimens are fully as large as specimens from the Atlantic States; the seven skulls from Tehuantepec (all of which are, however, very old specimens), of which measurements are given in Table XXVIII, average rather larger than those from the United States. Specimens No. 136 (from Mississippi) and No. 11439 (from Merida, Yucatan) are as near in color in every respect as two specimens from the same locality can be expected to be. A specimen from the plains of Chihuahua is smaller and rather paler, more nearly approaching variety *nutalli* than variety *sylvaticus*.

Southern specimens generally have the ears less covered than northern ones, the feet less heavily furred, and the general pelage harsher and less full. Southern specimens also show a tendency to decidedly longer ears than northern ones. On the whole, however, this species presents much more than the average stability of character.

In the following tables, the measurements pertaining to the general size have been taken from Professor Baird, my own material being essentially the same as his; the measurements of the skulls are, however, all original.

VAR. *NUTTALLI*.

*Sage Hare.*

Variety *nutalli* differs from var. *sylvaticus* mainly in its *paler tints* and rather smaller *size*; proportions the same. Above yellowish-gray or brownish-white, varied with black; sides of body and rump whitish. Hairs with long black tips, as in var. *sylvaticus*, but with the subterminal zone pale yellowish-white. Under-fur grayish-plumbeous at base, passing into yellowish-brown apically. Posterior part of the back and the rump mixed black and white.

As compared with variety *sylvaticus*, this form seems distinguishable mainly by or tints. Specimens from the plains of the Upper Missouri



are scarcely smaller than those from Iowa or the Eastern States, while the proportions seem to be absolutely the same.

This form was formerly supposed to be much smaller than *L. sylvaticus*, but the large number of specimens before me indicates but a slight average difference in size, var. *nuttalli* being rather the smaller, with a very decided decrease in size to the southward. Specimens from the northward have a fuller and softer pelage and more heavily-clothed ears and feet than var. *sylvaticus* anywhere presents. In those from along the eastern edge of the plains, the tints are brighter than in those from further westward; specimens from along the Missouri, from about Fort Leavenworth to above Fort Randall, being so nearly intermediate between the typical *nuttalli* and *sylvaticus* that the majority of them may be as well referred to the one form as to the other, while there may occur occasionally typical examples of each. The lightest specimens appear to be those from Western Wyoming, Colorado, Nevada, and Utah; Arizona specimens passing gradually into variety *arizona*. Winter specimens are rather lighter than summer ones. In some of the former, the subterminal zone of the hairs presents but a faint trace of yellowish, while the sides and hinder part of the back are of a delicate gray, from the intimate blending of the black and white hairs. Through the excessive paleness or almost total obsolescence of the yellowish-brown tint so conspicuous in var. *sylvaticus*, the black tips of the hairs are more conspicuous, standing out in stronger relief against the nearly white ground-color, and thus sometimes give the effect of a greater amount of blackness.

The average length of the body in a series of nineteen specimens from various localities is 13.75 inches, with the extremes ranging from 12.00 to 16.00; of hind foot, 3.41 inches, with the extremes ranging from 3.00 to 4.25. The average length of fifteen specimens from the Atlantic slope is 15.35; of twenty specimens from the vicinity of the Missouri River (from various localities between Fort Randall and Fort Leavenworth), is 15.50. Variety *nuttalli* hence averages about one and a half inches shorter than var. *sylvaticus*, or about 12 per cent. smaller. The measurements of the skulls indicate about the same proportionate difference in size.

There are in the collection a considerable number of specimens collected in the vicinity of Brownsville and Matamoras, near the mouth of the Rio Grande. These include Baird's types of his *L. "bachmani"* (= *bachmani* Waterhouse), which I at first referred to variety *nuttalli*, but now believe to



come in more naturally with the variety *syvaticus* series. They agree in their small size with other Texas specimens, but, though rather paler than average *syvaticus*, do not present the degree of pallor that characterizes the specimens from the plains further westward.

Var. ARIZONÆ.

*Desert Hare.*

Rather smaller than variety *nutalli*, and paler, presenting the extreme phase of differentiation in respect to pallor of coloration. The specimen on which this variety is primarily based was collected by Dr. Elliott Coues at "Beal's Springs, fifty miles west of Fort Whipple, Arizona, September 8, 1865". On the back of the label is written, in Dr. Coues's handwriting, "The common 'cotton-tail' of the Territory—new species ??—*artemisia* ?"; indicating that he recognized it as something different from the common so-called *Artemisia* Rabbit of the plains. The color above is a very pale, faded, yellowish-gray, very slightly mixed with black. The nape-patch is pale yellowish-fulvous, and the usual reddish parts of the legs and feet are pale yellowish-brown. The most important character, however, is the great size of the ears, which give it at first sight almost the appearance of a young "Jack" Rabbit. The ears are fully a third longer, and proportionally broader, than in specimens of the typical Sage Hare (var. *nutalli*) from the arid plains of Utah, Colorado, Wyoming, and neighboring regions northward. Other specimens, from Camp Grant (sixty miles east of Tucson), Arizona, collected in February, 1867, by Dr. E. Palmer, agree with Dr. Coues's specimen in the great length of the ears, but in color do not differ materially from the ordinary form of var. *nutalli*.

Its habitat seems to be the deserts of Arizona, and its chief characteristic the great length and size of the ears.

Var. AUDUBONI.

*Audubon's Hare.*

About the size of variety *syvaticus*, or a little less, with rather longer ears, and nearly the coloration of *L. trowbridgei*. The coloration of the original specimens from near San Francisco and San Diego, Cal., presents much the same peculiar phase in respect to the dorsal surface as that of

*L. townbridgei*, namely, a finely-mixed pale yellowish-brown and black. The lower parts, however, are white, instead of plumbeous-gray, and the color above is rather lighter than in *L. townbridgei*. It is easily distinguished from the latter, not only by the different color of the lower parts, but by its longer tail. While merely the darker Pacific-coast phase of the *L. sylvaticus* group, it finds its closest resemblance in external features in the *L. townbridgei*. To the eastward, it merges into variety *nuttalli* of the interior deserts; and to the southeastward, into the very light, very large-eared phase of the *sylvaticus* group which I called variety *arizonæ*.

TABLE XXXII.—Measurements of *LEPUS SYLVATICUS* var. *SYLVATICUS*.

Catalogue-number.	Locality.	Sex.	From tip of nose to—				Tail to end of—		Length of hind foot.	Height of ear.	Nature of specimen.	Remarks.
			Eye.	Ear.	Occip.	Tail.	Vert.	Hairs.				
957	Middleborough, Mass.	.....	.....	.....	3.50	16.25	1.53	2.48	3.60	2.25	Skin	From Prof. Baird.
958	do	.....	.....	.....	3.00	15.00	1.30	2.01	3.30	2.00	do	do.
304	Washington, D. C.	.....	.....	.....	3.25	16.75	2.00	2.75	3.56	2.23	do	do.
305	do	.....	.....	.....	3.50	15.50	1.60	2.40	3.70	3.00	do	do.
306	do	.....	.....	.....	3.70	16.00	.....	.....	3.68	2.30	do	do.
465	do	♂	.....	.....	3.90	16.50	1.63	2.43	3.20	2.70	do	do.
466	do	♀	.....	.....	3.25	14.25	1.66	2.00	3.35	2.38	do	do.
906	do	.....	.....	.....	3.30	15.00	1.45	2.35	3.60	2.60	do	do.
1290	do	.....	.....	.....	3.30	14.50	1.35	2.15	3.50	2.60	do	do.
1299	do	.....	.....	.....	3.15	14.50	1.40	2.25	3.75	2.55	do	do.
1357	Society Hill, N. C.	.....	.....	.....	3.07	13.50	1.30	1.90	3.45	2.65	do	do.
244	Seima, Ala.	.....	.....	.....	3.60	16.00	.....	.....	3.65	2.55	do	do.
136	Washington, Miss.	.....	.....	.....	3.40	15.50	.....	.....	3.60	2.50	do	do.
2304	Prairie Mer Rouge, La.	.....	.....	.....	3.00	14.50	1.70	2.40	3.33	2.40	do	do.
2970	Indianola, Tex.	.....	.....	.....	2.90	15.50	.....	.....	3.30	.....	do	do.
188	Racine, Wis.	.....	.....	.....	3.80	17.00	1.70	2.50	4.30	2.67	do	do.
1304	Wisconsin	.....	.....	.....	2.95	15.00	1.50	2.45	3.95	2.10	do	do.
1143	Fort Des Moines, Iowa.	.....	.....	.....	3.75	16.50	1.45	2.85	4.12	2.35	do	do.
1137	do	.....	.....	.....	3.60	16.40	1.34	2.24	3.80	2.15	do	do.
1138	do	.....	.....	.....	2.80	17.00	1.00	2.30	3.80	2.25	do	do.
1139	do	.....	.....	.....	3.50	16.40	1.50	2.40	3.90	2.12	do	do.
1140	do	.....	.....	.....	3.60	16.50	1.60	2.30	3.90	2.30	do	do.
1141	do	.....	.....	.....	3.40	16.00	1.48	2.28	3.92	2.00	do	do.
1142	do	.....	.....	.....	3.25	16.50	1.50	2.25	3.95	2.33	do	do.
1143	do	.....	.....	.....	3.75	16.45	1.45	2.20	3.70	2.30	do	do.
1145	do	.....	.....	.....	3.80	16.50	1.50	.....	3.90	2.25	do	do.
1146	do	.....	.....	.....	3.50	16.00	1.50	2.30	3.70	2.30	do	do.
1147	do	.....	.....	.....	3.30	15.50	1.23	2.00	3.70	.....	do	do.
1148	do	.....	.....	.....	3.32	14.50	1.45	2.25	3.85	2.30	do	do.
11350	Fort Randall, Dak.	♂	1.28	3.25	3.50	15.00	.....	3.00	.....	.....	Fresh	From Dr. Coates.
11349	do	♂	1.75	3.00	3.25	13.50	.....	2.50	.....	.....	do	do.
717	Fort Leavenworth, Kans.	♂	.....	.....	3.60	14.00	1.40	2.05	3.60	2.30	Skin	From Prof. Baird.
1492	do	.....	.....	.....	3.05	15.50	.....	3.23	2.90	.....	do	do.
1493	do	.....	.....	.....	3.00	12.00	1.45	2.10	2.90	2.40	do	do.
1494	do	.....	.....	.....	3.10	13.00	.....	3.55	2.80	.....	do	do.

TABLE XXXIII.—Measurements of skulls of *LEPUS SYLVATICUS* var. *SYLVATICUS*.

Catalogue-number.	Original number.	Locality.	Sex.	Total length.	Greatest width.	Distance between orbits.	Nasal bones, length.	Nasal bones, width behind.	Nasal bones, width before.	Upper incisors from front to hind margin of palate.	Upper incisors from front to hind margin of palate.	Upper incisors, height.	Upper incisors, width between external edges.	Upper incisors, length taken together.	Upper molars, distance between.	Lower jaw, length.	Lower jaw, height.	Remarks.
9002	957	Middleborough, Mass.	.....	2.70	1.37	0.83	1.05	0.59	0.50	0.84	1.15	.....	0.55	0.37	1.86	1.30		
755	.....	Carlisle, Pa.	.....	2.78	1.40	0.70	.....	0.53	.....	0.90	1.50	0.58	0.58	0.44	.....	.....		
3257	.....	do	.....	2.63	1.34	0.85	1.60	0.53	0.46	0.70	1.00	0.31	0.25	0.50	0.42	1.75	1.53	
3255	.....	do	.....	2.83	1.54	0.79	1.20	0.65	0.59	0.91	1.26	0.33	0.30	0.53	0.46	2.00	1.30	Very old.
6094	.....	do	.....	2.88	1.47	0.72	1.25	0.67	0.50	0.96	1.26	0.37	0.25	0.55	0.47	2.05	1.34	do.
4752	.....	do	.....	3.04	1.47	0.85	1.37	0.61	0.54	1.00	1.31	0.31	0.27	0.60	0.45	2.03	1.37	do.
4831	.....	do	.....	2.84	1.44	0.75	1.27	0.67	0.50	0.87	1.30	0.31	0.25	0.56	0.40	1.90	1.31	do.
1230	306	Washington, D. C.	.....	2.85	1.44	0.86	1.16	0.64	0.50	0.90	1.30	0.34	0.26	0.55	0.40	2.00	1.30	
1287	305	do	.....	2.77	1.41	0.82	1.20	0.57	0.50	0.90	1.25	0.26	0.25	0.54	0.33	1.97	1.32	
1331	.....	do	.....	3.00	1.41	0.88	1.32	0.56	0.48	0.92	1.37	0.27	0.27	0.55	0.42	.....	.....	
1952	906	do	.....	2.85	1.43	0.70	1.25	0.65	0.50	0.90	1.25	0.28	0.28	0.55	0.40	1.90	1.36	Very old.
9690	1389	do	.....	2.60	1.30	0.70	1.05	0.52	0.46	0.75	1.07	0.26	0.26	0.47	0.33	1.81	1.17	
9191	1390	do	.....	2.85	1.40	0.70	1.25	0.58	0.50	0.90	1.30	0.26	0.25	0.56	0.40	1.96	1.30	
8093	1392	do	.....	2.90	1.40	0.73	1.18	0.50	0.46	0.90	1.25	0.31	0.30	0.55	0.40	1.98	1.30	
9407	.....	do	.....	2.80	1.41	0.65	1.15	0.53	0.49	0.85	1.20	0.27	0.26	0.55	0.44	1.95	1.25	Very old.
9457	.....	Georgia.	.....	2.80	1.41	0.74	1.19	0.60	0.50	0.93	1.25	0.33	0.25	0.59	0.42	1.90	1.32	
9458	.....	do	.....	2.66	1.40	0.74	1.17	0.54	0.46	0.86	1.17	0.35	0.27	0.50	0.42	1.80	1.28	
3807	.....	do	.....	2.97	1.41	0.74	1.32	0.60	0.50	0.96	1.27	0.31	0.26	0.55	0.42	2.02	1.30	Very old.
3908	.....	do	.....	2.20	1.36	0.74	.....	0.54	.....	0.92	1.00	0.30	0.25	0.55	0.43	1.93	1.33	do.
3909	.....	do	.....	2.80	1.43	0.63	1.10	0.57	0.50	0.87	1.23	0.35	0.27	0.59	0.42	1.94	1.35	Very old.
635	.....	do	.....	2.88	1.40	0.73	1.20	0.60	0.50	0.95	1.30	0.28	0.25	0.51	0.41	1.90	1.37	
3250	.....	do	.....	2.55	1.37	0.65	1.00	0.50	0.40	0.76	1.07	0.31	0.26	0.50	0.37	1.78	1.30	
5068	.....	do	.....	2.90	1.45	0.76	1.25	0.55	0.50	0.94	1.23	.....	0.56	0.45	0.92	1.25		Very old.
7454	.....	Texas.	.....	2.65	1.33	0.73	1.15	0.55	0.46	0.86	1.10	0.29	0.26	0.47	0.40	1.78	1.15	do.
7496	.....	do	.....	2.78	1.41	0.70	1.27	0.63	0.50	0.92	1.26	0.27	0.25	0.57	0.42	1.90	1.47	do.
7497	.....	do	.....	2.81	1.38	0.70	1.25	0.57	0.50	0.93	1.22	0.30	0.25	0.53	0.42	1.89	1.38	
7499	.....	do	.....	2.78	1.32	0.70	1.23	0.60	0.57	0.86	1.20	.....	0.50	0.36	.....	.....		Very old.
3316	3100	Saint Louis, Mo.	.....	3.10	1.40	0.74	1.40	0.57	0.54	0.97	1.26	0.30	0.25	0.56	0.43	2.13	1.37	
3134	3103	Prairie Mer Rouge, La.	.....	2.80	1.38	.....	1.20	0.60	0.48	.....	.....	0.52	0.40	.....	.....	.....		Very old.
8603	.....	Tehuantepec, Mexico	.....	2.82	1.31	0.66	1.25	0.56	0.46	0.90	1.24	.....	0.53	0.45	1.95	1.37		
8654	.....	do	.....	2.75	1.31	0.71	1.15	0.57	0.50	0.86	1.15	0.33	0.26	0.52	0.38	1.87	1.35	
8967	.....	do	.....	2.74	1.30	0.73	1.20	0.55	0.50	0.85	1.15	0.30	0.24	0.46	0.38	1.87	1.27	
13863	.....	do	.....	3.05	1.31	0.83	1.36	0.67	0.56	1.03	1.30	0.28	0.26	0.46	0.40	2.17	1.40	
13869	.....	do	.....	2.95	1.37	0.80	1.25	0.60	0.50	0.90	1.25	0.27	0.25	0.52	0.40	2.00	1.35	
13864	.....	do	.....	2.95	.....	0.80	1.32	0.66	0.48	0.95	1.32	0.25	0.25	0.51	0.38	2.10	1.38	
13470	.....	do	.....	3.08	1.31	0.78	1.40	0.63	0.55	1.00	1.27	.....	0.53	0.45	2.12	1.40		
1193	334	Brownsville, Tex.	.....	2.65	1.31	0.65	1.12	0.47	0.44	0.85	1.04	0.28	0.23	0.50	0.42	1.90	1.28	
8069	9975	.....	♀	2.80	1.32	0.67	1.30	0.53	0.50	0.90	1.20	0.28	0.27	0.50	0.40	1.97	1.35	
1583	.....	Matamoros, Tex.	.....	2.66	1.28	0.61	1.05	0.41	0.40	0.90	1.17	0.25	0.24	0.50	0.37	1.90	1.30	Very old.
1217	.....	do	.....	2.56	1.21	0.62	1.04	0.50	0.46	0.81	1.15	0.33	0.22	0.46	0.37	.....	1.28	
1218	.....	do	.....	2.67	1.33	0.71	1.10	0.55	0.44	0.81	1.11	0.29	.....	0.52	0.40	1.76	1.26	Very old.
1219	.....	do	.....	2.43	1.27	0.65	0.92	0.45	0.44	0.73	1.04	.....	0.47	0.35	1.70	1.18		

Marked L.  
"bachmanl."

TABLE XXXIV.—List of specimens of *LEPUS SYLVATICUS* var. *SYLVATICUS*.

Catalogue-number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
*1447				Massachusetts		L. Agassiz	L. Agassiz	Skin.
*1533				do		do	do	do.
*1534				do		do	do	do.
8141				do		Boat. Soc. Nat. Hist.	do	do.
8142				do		do	do	do.
958				Middleborough, Mass.		J. W. P. Jenks	J. W. P. Jenks	do.
959	9008			do		do	do	Skin and skull.
11068				New York		J. G. Bell	J. G. Bell	Skin.
11069				do		do	do	do.
4017				do		do	do	do.
4759				Carlisle, Pa.		Prof. S. F. Baird	Prof. S. F. Baird	Skull.
6004				do		do	do	do.
4631				do		do	do	do.
925				do		do	do	do.
755				do		do	do	do.
3935				do		do	do	do.
3956				do		do	do	do.
3957				do		do	do	do.
305	1997			Washington, D. C.		do	S. G. Brown	Skin and skull.
306	1939			do		do	do	do.
1931				do		do	C. Drexler	Skull.
906	1958			do		do	do	Skin and skull.
1090				do		do	do	Skin.
465			♂	do	Jan. 8, 1885	do	Prof. S. F. Baird	do.
466			♀	do	Jan. 31, 1885	do	do	do.
4015				do		do	do	do.
1829	9006			do	Feb. —, 1886	do	do	Skin and skull.
1890	9001			do	Jan. —, 1886	do	do	do.
1891	9009			do	Jan. —, 1886	do	do	do.
9407				do		do	do	Skull.
1894				do		do	do	do.
5144				do		do	do	Skin.
1857	9087			Society Hill, S. C.		M. A. Curtis & Sons	M. A. Curtis & Sons	Skin and skull.
1858				do		do	do	Skin.
9457				Georgia		do	do	Skull.
9458				do		do	do	do.
3007				do		do	do	do.
3008				do		do	do	do.
3009				do		do	do	do.
*9884				Florida		C. J. Maynard	C. J. Maynard	Skin.
*9895			♂	do		do	do	do.
*9446			♀	Jacksonville, Fla.		do	do	do.
*9447			♂	Dummitt's, Fla.		do	do	do.
*9445			♀	do		do	do	do.
136				Washington, Miss.		Col. B. L. C. Waller	Col. B. L. C. Waller	do.
9305	3134			Prairie Mer Rouge, La.		J. Fairie	J. Fairie	Skin and skull.
1897		19		Indianola, Tex.	Feb. 14, 1885	Capt. J. Pope	G. Lincoo	Skin.
7497				Texas		G. Lincoo	G. Lincoo	Skull.
7498				do		do	do	do.
7499				do		do	do	do.
7500		13		do		do	do	do.
943	1234			Brownsville, Tex.		Capt. Van Vliet	Capt. Van Vliet	Skin.

\* Specimens from Museum of Comparative Zoology, Cambridge, Mass.

TABLE XXXIV.—List of specimens of *LEPUS SYLVATICUS* var. *SYLVATICUS*—Continued.

Catalogue-number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
234	1193			Brownsville, Tex.		Capt. Van Vliet.	Capt. Van Vliet.	Skin.
9061	7736			Leug Point, Tex.		G. Lincoecum.	G. Lincoecum.	Skin and skull.
3100	3316			Saint Louis, Mo.	May —, 1857	Lieut. D. F. Brown.	W. S. Wood.	do.
717			♂	Ft. Leavenworth, Kans.	Jan. 30, 1855	Lieut. D. N. Couch.		Skin.
3152				do.	July 5, 1857	Wm. M. McGraw.	Dr. J. G. Cooper.	do.
1499				do.	Apr. 21, 1857	Lieut. G. E. Warren.	W. S. Wood.	do.
1491				do.		do.	do.	do.
1394	9231	919		Missouri.		J. G. Bell.	J. G. Bell.	Skin and skull.
9275	8099			Fort Cobb, Ind. T.		Dr. E. Palmer.	Dr. E. Palmer.	do.
189				Racine, Wis.		Dr. P. R. Hoy.	Dr. P. R. Hoy.	Skin.
1138				Ft. Des Moines, Iowa	Autumn, 1855	W. E. Moore.	W. E. Moore.	do.
1140				do.	do.	do.	do.	do.
1141				do.	do.	do.	do.	do.
1143				do.	do.	do.	do.	do.
1145				do.	do.	do.	do.	do.
1146				do.	do.	do.	do.	do.
	9094			do.	do.	do.	do.	Skull.
1796	9510			Sioux City, Iowa.	Oct. 28, 1856	Lieut. G. E. Warren.	Dr. F. V. Hayden.	Skin and skull.
1483				Lower Missouri River	—, 1856	do.	do.	Skin.
1490				80 miles above Council Bluffs.		do.	do.	do.
1609				Fort Pierre, Dak.		do.	do.	do.
926			♀	do.		do.	Dr. J. Evans.	do.
7769			♂	Republican Fork, Kans.	May 23, 1864	Dr. E. Cones.	Dr. E. Cones.	do.
11350	2679		♂	Fort Randall, Dak.	Jan. 2, 1872	do.	do.	do.
11349	2680		♂	do.	Jan. 2, 1872	do.	do.	do.
8664	9373	5	♂	Tehuantepec, Mexico.	Aug. 31, 1866	F. Sumichrast.	F. Sumichrast.	Skin and skull.
8663	9378	82		do.	Oct. 27, 1866	do.	do.	do.
8667	9431	30		do.	Nov. 21, 1866	do.	do.	do.
13470				do.		do.	do.	Skull.
13869		1		do.		do.	do.	do.
13863		2		do.		do.	do.	do.
13864		3		do.		do.	do.	do.
	9506	61		do.	May —, 1869	do.	do.	Skin.
7908				Orizaba, Mexico		M. Botteri?	M. Botteri?	do.
8118				do.		do.	do.	do.
8569				do.		do.	do.	do.
8563			♀	do.		do.	do.	do.
8564			♀	do.		do.	do.	do.
8565			♀	do.		do.	do.	do.
8566				Mirador, Mexico		Dr. C. Sartorius.	Dr. C. Sartorius.	do.
8609				Merida, Yucatan.		J. S. Llarrequi.	Dr. A. Schott.	
11435	253	♀		do.		do.	do.	
11436	174	♂		do.		do.	do.	
11438	260	♀		do.		do.	do.	
11439	273			do.		do.	do.	
11443	173	♀		do.		do.	do.	

TABLE XXXV.—Measurements of *LEPUS SYLVATICUS* var. *NUTTALLI*.

Catalogue number.	Original number.	Locality.	Sex.	From tip of nose to—				Tail to end of—		Length of—		Height of ear.	Nature of specimen.	Remarks.
				Eye.	Ear.	Occip.	Tail.	Verteb.	Hairs.	Fore foot.	Hind foot.			
80		Columbia River, Oregon Territory.	♂	1.33	2.42	2.20	13.10				3.25	2.15	Skin	From Baird.
999		Fort Dalles, Oregon Territory.	♂			2.75	15.00						do	do.
993		do					12.00	2.00	2.50		3.22	2.30	do	do.
1666		Percy, Wyoming Territory.	♂	1.80	3.00	3.10	15.00	1.10	2.50	2.10	4.25		Flesh	
1665		do	♂	1.85	2.85	3.25	14.25	1.25	2.00	2.05	3.85		do	
1678		do	♂	1.75	2.50	2.85	13.00	1.50		1.10	3.75	3.35	do	
1746		do		1.80	2.80	3.10	14.25	2.00	3.00	1.90	3.75	3.25	do	
658		Park County, Colorado		1.00		3.10	10.00	2.50		1.85	3.45		do	
697		do		1.85		3.17	13.25	2.00	2.00	1.75	3.60		do	
600		do		1.70		2.85	13.75	1.00	2.00	1.75	3.35		do	
1790		Yellowstone River				2.90	12.00				3.55		Skin	From Baird.
987		Chihuahua City		1.25	2.42	2.75	13.50	1.25	2.00		3.10	2.40	do	do.
228		do		1.42	2.42	2.83	11.50	1.00	1.58		3.00	2.50	do	do.
373		Pecos to Rio Grande				2.88	12.00				3.28	2.33	do	do.
314		Llano Estacado				3.00	15.25				3.20		do	do.
1793		Crossing of Pecos R.				2.90	15.70				3.08	2.57	do	do.
1734		do				3.50	16.00	1.00	1.70		3.25	2.70	do	do.
1796		do				2.35	14.00	1.30	2.01		2.90		do	do.
315		San Antonio to El Paso		1.25	2.75	2.95	12.10	1.23	2.08		3.13	2.45	do	do.

TABLE XXXVI.—Measurements of skulls of *LEPUS SYLVATICUS* var. *NUTTALLI*.

Catalogue number.	Locality.														
		Total length.	Greatest width.	Distance between orbits.	Nasal bones, length.	Nasal bones, width behind.	Nasal bones, width before.	Upper incisors from front to molars.	Upper incisors from front to hinder margin of palate.	Upper incisors, height.	Upper incisors, width between external edges.	Upper molars, length taken together.	Upper molars, distance between.	Lower jaw, length.	Lower jaw, height.
4256	Deer Creek, Wyoming	2.75	1.37	0.70	1.23	0.70	0.50	0.90	1.17	0.33	0.25	0.47	0.37	1.83	1.36
4259	do	2.80	1.45	0.68	1.26	0.53	0.50	0.91	1.15	0.37	0.25	0.50	0.38	1.98	1.40
4300	do	2.80	1.37	0.70	1.23	0.50	0.50	0.93	1.13	0.37	0.25	0.50	0.37	1.84	1.42
4361	do	2.67	1.40	0.67	1.10	0.53	0.50	0.85	1.15	0.30	0.25	0.35	0.37	1.85	1.23
6872	Wyoming Territory	2.56	1.31	0.55	1.06	0.53	0.46	0.88	1.10	0.30	0.25	0.52	0.38	1.77	1.17
1933	Western Texas	2.50	1.26	0.66	1.05	0.49	0.40	0.80	1.18	0.28	0.21	0.44	0.31	1.75	1.23
1939	do	2.55	1.35	0.69	1.19	0.7	0.44	0.82	1.10	0.38	0.24	0.47	0.40	1.80	1.30
1987	do	2.50	1.30	0.70	1.06	0.52	0.50	0.77	1.05	0.27	0.22	0.45	0.35	1.80	1.06

TABLE XXXVII.—List of specimens of *LEPUS SYLVATICUS* var. *nutalli*.

Catalogue-number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
12011	4120			Frenchman's R., Mont.	July 4, 1874	A. Campbell	Dr. E. Coues	Skin.
222				Missouri R., 100 miles above Fort Union.	Aug. 17, 1833	Gov. I. I. Stevens	Dr. Geo. Suckley	do.
1404				Upper Missouri		Lieut. G. K. Warren	Dr. F. V. Hayden	do.
1668				Fort Pierre, Dak.		do	do	do.
1798	♂			Fort Union, Mont.	July 14, 1856	do	do	do.
1800				do	July 19, 1856	do	do	do.
	91	♀		Powder River	Aug. 3, 1856	do	do	do.
	4256			Deer Creek		do	do	Skull.
	4259			do		do	do	do.
	4960			do		do	do	do.
	4961			do		do	do	do.
9634	49			Camp Carlin, Wyo.	Aug. 3, 1870	Dr. F. V. Hayden	H. D. Schmidt	Skin.
9649	387			Big Sandy, Wyo.	Sept. 7, 1870	do	do	do.
9751	430	♀		Green River, Wyo.	Sept. 11, 1870	do	do	do.
9752	508			Fort Bridger, Wyo.	Sept. 27, 1870	do	do	do.
9753	636			Henry's Fork, Wyo.	Oct. 3, 1870	do	do	do.
9754	679			Green River, Wyo.	Oct. 7, 1870	do	do	do.
9755	685			do	Oct. 7, 1870	do	do	do.
9760	707			do	Oct. 9, 1870	do	do	do.
9756	714			do	Oct. 10, 1870	do	do	do.
9769	719			do	Oct. 10, 1870	do	do	do.
9737	731			do	Oct. 10, 1870	do	do	do.
9738	738			do	Oct. 11, 1870	do	do	do.
9759	770			Bitter Creek, Wyo.	Oct. 15, 1870	do	do	do.
9760	820			North Platte, Wyo.	Oct. 19, 1870	do	do	do.
9770	808			Pine Grove, Wyo.	Oct. 30, 1870	do	do	do.
9761	824			do	Oct. 32, 1870	do	do	do.
9762	838			do	Oct. 32, 1870	do	do	do.
9763	838			Pase Creek, Wyo.	Oct. 32, 1870	do	do	do.
9764	865			Rock Creek, Wyo.	Oct. 25, 1870	do	do	do.
9765	866			do	Oct. 25, 1870	do	do	do.
9766	867			do	Oct. 25, 1870	do	do	do.
9767	281			North Platte, Wyo.	Aug. 24, 1870	do	do	do.
9604				Colorado Territory	Aug. —, 1869	do	J. Stevenson	do.
9605				Don Carlos, Colo.	Aug. 18, 1869	do	do	do.
9606				do	Aug. 18, 1869	do	do	do.
9603				Idaho City, Colo.	July 16, 1869	do	do	do.
12738	1009	♀		South Park, Colo.	July 29, 1871	Rocky Mt. Exped.	J. A. Allen	do.
12739	1010			do	July 29, 1871	do	do	do.
12757	658	♂		do	July 10, 1871	do	do	do.
12756	697	♂		do	July 10, 1871	do	do	do.
12755	600			Bear Creek, Colo.	July 29, 1871	do	do	do.
12753	551	♀		Cheyenne, Wyo.	Aug. 9, 1871	do	do	do.
12848	1665			Percy, Wyo.	Nov. 10, 1871	do	Allen & Bennett	do.
12849	1746	♀		do	Dec. 10, 1871	do	do	do.
12850	1666			do	Nov. 10, 1871	do	do	do.
12851	1678	♂		do	Nov. 15, 1871	do	do	do.
12852	1616			do	Nov. 1, 1871	do	do	do.
12760	1533	♂		Ogden, Utah	Sept. 25, 1871	do	do	do.
1453	✓			Fort Bridger, Utah	Apr. 15, 1855	W. M. McGraw	C. Drexler	do.
11337	308			Beaver, Utah	Sept. 26, 1872	Lieut. G. M. Wheeler	H. W. Henshaw	do.

\* L. "nutalli."

† Specimen from Museum of Comparative Zoölogy, Cambridge, Mass.

TABLE XXXVII.—List of specimens of *LEPUS SYLVATICUS* var. *NUTTALLI*—Continued.

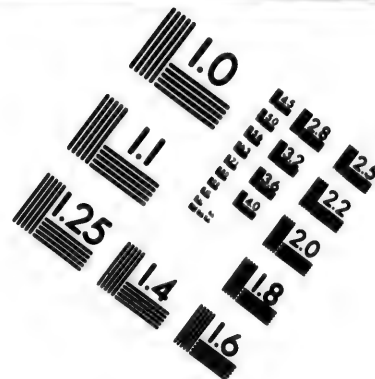
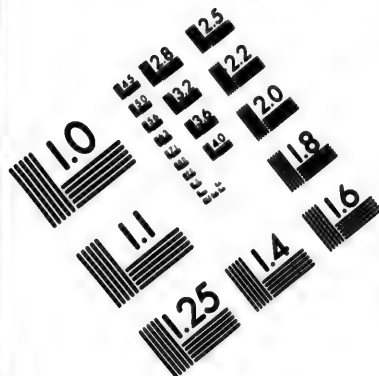
Catalogue-number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
9317	.....	305	♂	Camp 96 .....	.....	Clarence King .....	R. Ridgway .....	do.
11737	.....	249	♀	Fort Garland, Colo. ....	June 4, 1873 .....	Lieut. G. M. Wheeler .....	H. W. Henshaw .....	do.
11738	.....	531	♂	do .....	June 5, 1873 .....	do .....	do .....	do.
.....	.....	250	♂	do .....	June 5, 1873 .....	do .....	do .....	do.
11739	.....	293	♀	do .....	June 7, 1873 .....	do .....	do .....	do.
11730	.....	294	♂	do .....	June 7, 1873 .....	do .....	do .....	do.
11731	.....	318	♀	do .....	June 3, 1873 .....	do .....	do .....	do.
.....	.....	191	♂	do .....	June 22, 1873 .....	do .....	do .....	do.
11738	.....	331	♀	Rio Grande, Colo. ....	June 13, 1873 .....	do .....	do .....	do.
11870	.....	293	.....	Southern Arizona .....	Oct. —, 1873 .....	do .....	do .....	do.
11879	.....	208	♂	do .....	Oct. 5, 1873 .....	do .....	do .....	do.
11889	.....	.....	♂	Ft. Wingate, N. Mex. ....	July 34, 1873 .....	do .....	do .....	do.
11881	.....	87	.....	do .....	July 14, 1873 .....	do .....	do .....	do.
11883	.....	435	.....	do .....	Sept. 14, 1873 .....	do .....	do .....	do.
3325	.....	.....	.....	Mohave Valley .....	.....	Lieut. J. C. Ives .....	J. B. Möhlhausen .....	do.
4504	.....	.....	.....	Cantonment Burgwyn, N. Mex. ....	.....	Dr. W. W. Anderson .....	Dr. W. W. Anderson .....	do.
3694	.....	.....	.....	Ft. Massachusetts, N. M. ....	.....	Captain Brown .....	Captain Brown .....	do.
1736	.....	111	.....	Pecos River, N. Mex. ....	July 18, 1855 .....	Capt. J. Pope .....	Dr. C. B. R. Kennerly .....	do.
373	.....	.....	.....	Between Pecos and Rio Grande. ....	.....	do .....	do .....	do.
3625	.....	.....	.....	Newfield, Tex. ....	.....	L. C. — .....	L. C. — .....	do.
314	.....	.....	.....	Llano Estacado, Tex. ....	.....	Capt. J. Pope .....	Capt. J. Pope .....	do.
313	1457	.....	.....	do .....	.....	do .....	do .....	Skin and skull.
315	.....	.....	.....	San Antonio, Tex. ....	.....	Lieut. Whipple .....	Lieut. Whipple .....	Skin.
.....	1223	.....	.....	do .....	.....	do .....	do .....	Skull.
1456	.....	.....	.....	Pecos, Tex. ....	.....	Capt. J. Pope .....	Capt. J. Pope .....	Skin.
1454	.....	.....	.....	do .....	.....	do .....	do .....	do.
8578	129	♀	♀	Larado, Tex. ....	May 14, 1896 .....	Dr. H. B. Butcher .....	Dr. H. B. Butcher .....	do.
8579	140	♂	♂	do .....	May 15, 1896 .....	do .....	do .....	do.
8617	498	♂	♂	do .....	Aug. 25, 1896 .....	do .....	do .....	do.
8618	874	♂	♂	do .....	June 20, 1896 .....	do .....	do .....	do.
287	.....	.....	.....	Plains of Chihuahua. ....	Oct. 16, 1854 .....	J. Poite .....	J. Poite .....	do.
299	.....	.....	.....	do .....	Oct. 16, 1854 .....	do .....	do .....	do.
86	.....	.....	.....	Columbia River .....	.....	J. K. Townsend .....	J. K. Townsend .....	do.
4010	.....	.....	.....	Oregon .....	.....	U. S. Expl. Exped. ....	Dr. W. Stimpson .....	do.

† Labeled L. "bockmani".

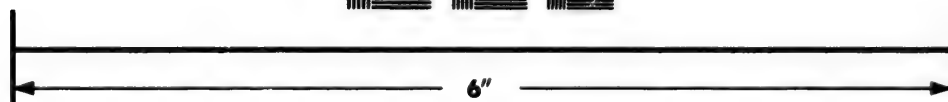
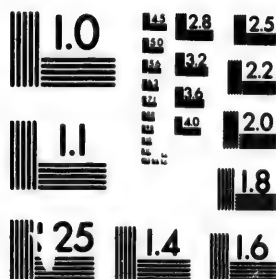
TABLE XXXVIII.—Measurements of skulls of *LEPUS SYLVATICUS* var. *ARIZONÆ*.

Catalogue-number.	Locality.	Total length.	Greatest width.	Distance between orbits.	Nasal bones, length.	Nasal bones, width behind.	Nasal bones, width before.	Upper incisors from front to molar.	Upper incisors from front to hinder margin of palato.	Upper incisors, height.	Upper incisors, width between external edges.	Upper molars, length taken together.	Upper molars, distance between.	Lower jaw, length.	Lower jaw, height.
8895	Camp Grant, Arizona .....	2.56	1.33	0.67	1.09	0.50	0.46	0.81	1.07	0.30	0.23	0.46	0.36	1.73	1.94





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TABLE XXXIX.—List of specimens of *LEPUS SYLVATICUS* var. ARIZONÆ.

Catalogue-number.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
8439	1563	♂	Beall's Springs, Ariz.	Sept. 8, 1865	Dr. E. Coues	Dr. E. Coues	Skin.
8440	1564	♀	Camp Grant, Ariz.	Feb. 10, 1867	Dr. E. Palmer	Dr. E. Palmer	do.
8441	1565	♂	do	Feb. 30, 1867	do	do	do.
8442	1566	♀	do	Mar. 10, 1867	do	do	do.
8443	1567	♂	do	Mar. 10, 1867	do	do	do.
8444	1568	♂	Kernville, Cal.	Oct. 1, 1875	Lt. G. M. Wheeler	H. W. Henshaw	do.

TABLE XL.—Measurements of *LEPUS SYLVATICUS* var. AUDUBONI.

Catalogue-number of skin.	Corresponding number of skull.	Locality.	Sex.	From tip of nose to—		Tail to end of—		Length of hind foot.	Height of ear.	Remarks.
				Occip.	Tail.	Verteb.	Hairs.			
300	9045	Presidio, Cal.	♂	3.60	14.50	1.50	2.25	3.17	3.08	From Baird.
1163	9046	San Francisco, Cal.	♂	3.90	15.00	.....	.....	3.08	.....	
1384	9047	San Diego, Cal.	♀	3.33	14.50	.....	3.15	.....	.....	
1586	9048	do	♂	.....	11.00	.....	3.00	.....	3.25	

TABLE XLI.—List of specimens of *LEPUS SYLVATICUS* var. AUDUBONI.

Catalogue-number of skin.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
300	9045	♂	Presidio, Cal.	.....	Lieut. W. P. Trowbridge	Lieut. Trowbridge	Skin.
1163	9046	♂	San Francisco, Cal.	.....	Lieut. R. S. Williamson	Dr. J. B. Newberry	Skull and skin.
4165	9047	♂	Fort Crook, Cal.	May 24, 1880	J. Feilner	J. Feilner	do.
4203	9048	♂	do	.....	do	do	do.
1591	9049	♀	San Diego, Cal.	Feb. 19, 1888	Dr. J. F. Hammond	Dr. J. F. Hammond	do.
1594	9050	♀	do	Dec. 28, 1888	do	do	do.
1596	9051	♂	do	Dec. 28, 1888	do	do	do.
3000	9052	♂	Fort Tejon, Cal.	.....	J. Kantna	J. Kantna	do.
3674	9053	♂	Cape St. Lucas, Cal.	.....	do	do	do.

*General remarks on LEPUS SYLVATICUS and its varieties.*

*Synonymy.*—The first clear and careful description of the little Wood Hare of the eastern portions of the United States was published by Schoepf in 1784.\* He gave it, however, no scientific name, calling it simply "Der

\* Der Naturforscher, 90 Stück, Halle, 1784. See Prof. Baird's translation in his *Mam. N. Amer.*, pp. 590, 600.

Nord-Amerikanische Haase". His description is detailed and precise, and is unmixed with allusions to any other species. Yet Schoepf's description was later almost universally cited among the references to *L. americanus*. The *L. americanus*, however, of Erxleben, and the *L. hudsonius* of Pallas, as previously shown, refer exclusively to the smaller Varying Hare of Hudson's Bay, which for many years was the only species of Hare supposed to inhabit North America south of the Arctic regions. Consequently, the *L. americanus* of most authors previous to about the year 1840 included more or less vague allusions to *L. sylvaticus*. Desmarest, however, in 1820, made the confusion complete by describing (from Schoepf's account) *L. sylvaticus* under the name *L. americanus*, although quoting references also to the Northern Varying Hare, and extending its habitat to embrace the region west of Hudson's Bay, as well as the more southern parts of the continent. His name was adopted by Harlan and other American authors for this species; even Dr. Bachman, in 1837, in his first article on the Hares, fell into the same error. He promptly, however, corrected the mistake, and adopted for the species, really up to this time without a scientific designation, the very appropriate specific name of *L. sylvaticus*. In his second article on the American *Leporidae*, published in 1839, he brought the name more prominently forward, since which time it has been in very general use.

The only other rival name is *nanus* of Schreber, which even some recent authors have still used in place of *sylvaticus*. Such a practice is, however, wholly unwarranted, as most clearly and exhaustively shown by Bachman in his later account of the species in Audubon and Bachman's North American Quadrupeds (vol. i, pp. 179-188, 1849). Schreber's description was compiled from previous authors, and in almost every detail applies to *L. americanus*, and scarcely in any particular to *L. sylvaticus*. His account of its habits and distribution includes both those of *L. americanus* and *L. sylvaticus*, he giving its habitat as extending from Hudson's Bay to Florida. His figure, however, Professor Baird believes to be clearly that of *L. sylvaticus*, but it bears really so little resemblance to either that it may be safely ignored. Schreber's account is evidently drawn in part from Schoepf, but largely also from Forster, Pennant, and Kalm.

The Hare from the plains of the Columbia, described by Dr. Bachman in 1837 as *Lepus nuttalli*, and regarded as "the most diminutive of any species of true Hare yet discovered", was undoubtedly but an immature speci-

men of the western variety of *sylvaticus*, as strongly conjectured to be the case by Professor Baird, and for which belief he has given ample reasons. Up to the present time, no adult Hare of this small size has yet been found anywhere, notwithstanding the testimony of Townsend that it "was doubtless an adult animal". He says the hunters, who knew it well, assured him it never grew any larger, but it seems probable that these hunters may have had in mind the Little Chief Hare (*Lagomys princeps*). A Hare so abundant as this is represented to be is not likely to have escaped the observation of the numerous naturalists and collectors who have since passed over the same region.

The *Lepus bachmani* was described by Waterhouse in 1838 from an immature specimen procured somewhere in the "southwestern portions of North America, supposed to be between California and Texas",\* or "perhaps California",† and redescribed from the same specimen in 1839 by Dr. Bachman. In the Quadrupeds of North America, it is mentioned as "described from a specimen sent by Douglass from the western shores of America".‡ It is here spoken of as abundant in Texas, its habitat being regarded as embracing "a great portion of Texas, New Mexico, and California", and as "probably extending south through great part of Mexico" and northeast to "about the headwaters of the Red River or Arkansas".‡ Professor Baird believes that the real locality of Waterhouse's and Bachman's first specimen (the one sent by Douglass) was Texas, although he was at first, on the ground of locality, inclined to identify it with what he afterward described as *Lepus auduboni*. The two specimens referred by Professor Baird to *L. "bachmani"* are from Brownsville, Texas, and are still in the collection of the Smithsonian Institution.

The *Lepus artemisia* was described by Dr. Bachman in 1839 from a specimen brought from Fort Walla-Walla by Mr. Townsend, who speaks of it as common there. It seems to have been recognized only from this locality till 1853, when Dr. Woodhouse referred specimens to it from the Zuni and Colorado Rivers. In 1857, Professor Baird referred to it specimens from Oregon, Nebraska, New Mexico, and Texas; and the name has since been generally used for the designation of the small Gray Hare of the plains and Rocky Mountain region generally.

\* Bachman, Journ. Acad. Nat. Sci. Phila., viii, 97.

† Waterhouse, Mam., ii, 124.

‡ And. and Bach., Quad. N. Amer., iii, 37.

*Lepus nuttalli* and *L. artemisia* were thus described from specimens obtained from the same locality, and the former was undoubtedly based on a young specimen of the form so currently known of late years as *L. artemisia*. The locality of the original specimens of *L. bachmani* is conjectural, and may have been either California or Texas, though probably the latter. Later, the name was applied by Audubon and Bachman to the small Gray Hare of the Texas plains, which is undoubtedly the same as the *L. artemisia*, described a year later, although the specimens so designated by Professor Baird more nearly approach var. *sylvaticus*. As noticed by Professor Baird, the name *nuttalli* has a priority of two years over *artemisia* and of one year over *bachmani*, the latter also preceding *artemisia* by one year. Hence it unfortunately happens that, according to the strict rule of priority, the name *artemisia*, which has become familiar as the appellation of the "Sage Rabbit" of the plains, must give way to the less familiar one of *nuttalli*, the original type of which was only an immature specimen of this now well-known species.

GEOGRAPHICAL DISTRIBUTION.—*Lepus sylvaticus* (including its several varieties) occupies the greater part of the southern half of the continent. In the eastern part of the United States, its northern limit coincides nearly with the northern limit of the Alleghanian fauna, or with the isotherm of 45°. This isotherm seems also to form its northern limit in the interior, or west of the Mississippi River. West of this point, it seems not to have been met with to the northward of the northern boundary of the United States. Variety *sylvaticus* extends from Southern Maine southward, throughout the States east of the Mississippi to Florida and the Gulf coast, excepting perhaps the more elevated portion of the Apalachian highlands. It also occurs throughout the States adjoining the Mississippi, as far westward even as the eastern portions of Nebraska, Kansas, and the Indian Territory, and also throughout Eastern Texas and thence southward to Yucatan. In Middle Kansas, or near the ninety-eighth meridian, it already begins to assume the characters of variety *nuttalli*, which ranges thence westward to Oregon and the Sierra Nevada Mountains, and southward from near the forty-ninth parallel into the highlands of Mexico. Over the drier portions of Arizona and the adjoining country, it passes into variety *arizonæ*, and on the Pacific slope is represented by variety *auduboni*. Variety *auduboni* extends along the Pacific coast from Northern California to San Diego, in Southern California passing

into variety *arizonæ*. The latter is as yet known only from Western Arizona, but will doubtless be found to extend over the western parts of Southern California and southward into Western Mexico, or over a large part of the so-called Sonoran district.

### LEPUS TROWBRIDGEI.

#### Trowbridge's Hare.

*Lepus trowbridgei* BAIRD, Proc. Acad. Nat. Sci. Phila., vii, 1855, 333; Mam. N. Am., 1857, 610, pl. xiv, (animal).—NEWBERRY, Pacific R. R. Ex. & Surv., vi, iv, 1857, 65.—KENNERLY, *ibid.*, x, vi, 1859, 17.—COOPER, *ibid.*, xii, iii, 1860, 87.—GRAY, Ann. and Mag. Nat. Hist., 3d ser., xx, 1867, 224.—ALLEN, Proc. Bost. Soc. Nat. Hist., xvii, 1875, 434.

Smallest of the North American *Leporidae*. Tail very short, almost rudimentary. Postorbital process scarcely in contact with the skull posteriorly. Ears, head, and hind feet about equal in length. Above yellowish-brown, varied with dark brown; sides, throat, and chest paler; beneath dusky gray, varying to whitish; back of neck rufous. Colors generally darker above and more finely blended than in any of the varieties of *L. sylvaticus*. The dark long hairs of the back appear to be generally blackish-brown, but in some specimens they are decidedly black.

The specimens before me are the same as those described by Professor Baird in 1857, with the exception of a few additional ones from Fort Tejon, and I find little to add to his account. As Professor Baird observes, there is considerable variation in respect to the length of the ears in different specimens and also in color, some specimens being decidedly whitish below instead of plumbeous-gray, and with the long dark hairs above decidedly black in some cases instead of blackish-brown.

Its nearest ally is the *Lepus sylvaticus* var. *auduboni*, but this form rather exceeds it in size, has the ears distinctly edged and tipped with blackish instead of being uniformly gray, is whiter below and of a more yellowish-gray above, with the longer black hairs more strongly in contrast with the general color. The variations in general color, however, in different individuals, respectively, of the two forms rather overlap, so that general color is not alone distinctively diagnostic. The shorter tail and (apparently) relatively shorter hind feet of *L. trowbridgei* are the more especially characteristic features. Both forms occur together on the Pacific slope; but *L. sylvaticus* variety *auduboni* ranges also to the desert plains of Southern Nevada and Arizona, where it insensibly blends with variety *nuttalli* of the middle region of the continent.

The variations in size in *Lepus trowbridgei* are well indicated in the subjoined tables of measurements of the skulls and external dimensions. The extremes in a series of ten skulls are: length, 2.28 and 2.55; width, 1.15 and 1.32; nasal bones (length), 0.90 and 1.17; lower jaw (length), 1.42 and 1.73. The length of the ear varies in different specimens from 2.28 to 3.05, the average being about 2.50 to 2.75. In specimens from the most southern localities, the ear averages considerably longer than in those from the northward, although the size of the animal, as indicated by measurements of the skull, is smaller at the southward. Thus the average length of four skulls from localities near San Francisco is 2.50 and the breadth 1.28; while the average length of the skull in four specimens from Cape Saint Lucas is 2.29, and of the breadth 1.17.

The habitat of *Lepus trowbridgei*, as indicated by the specimens in the present collection, seems to be restricted to the region east of the Cascade range of mountains, and to extend along the coast from Fort Crook to Cape Saint Lucas.

*Lepus trowbridgei* was first described by Professor Baird in 1855, and redescribed by him under the same name in 1857, by which appellation it has fortunately been always known. Very few original references have been made to the species aside from those in the various reports of the Pacific Railroad surveys and explorations.

TABLE XLII.—Measurements of *L. TROWBRIDGEI*.

Catalogue-number.	Locality.	Sex.	From tip of nose to—					Tail to end of—		Length of—		Remarks.
			Eye.	Ear.	Occip.	Tail.	Verteb.	Hairs.	Fore feet.	Hind feet.	Height of ear.	
310	San Francisco or Monterey, Cal.	...	1.40	2.58	2.00	12.00	0.48	1.96	1.40	2.66	2.35	From Baird.
311	do	...	1.35	2.42	2.50	16.17	0.50	...	...	2.75	2.35	do.
318	do	...	1.08	2.08	2.25	11.00	0.48	0.94	...	2.04	...	do.
1171	San Francisco, Cal.	...	1.40	2.40	2.00	12.50	...	...	1.35	2.75	2.33	From a skin.
*285	do	...	1.45	2.75	1.85	13.25	1.00	1.60	1.45	2.75	2.55	From a specimen in alcohol.
*308	do	...	1.42	2.70	2.75	13.75	0.90	1.88	1.50	2.65	2.30	do.
do	do	...	1.50	2.65	2.75	14.00	0.70	1.50	1.50	2.80	2.55	do.
889	Bodega, Cal.	...	1.35	2.40	2.03	14.50	...	...	1.58	2.65	2.98	From a skin.
1183	Santa Clara, Cal.	...	...	...	2.20	15.00	...	...	...	...	2.63	do.
8974	Petaluma, Cal.	...	1.48	2.53	2.98	...	...	...	...	...	2.78	do.
8975	do	...	1.41	2.45	2.85	...	...	...	...	...	2.68	do.
1380	San Diego, Cal.	♂	...	...	2.70	...	...	...	...	...	2.70	do.
1598	do	♀	1.35	2.65	2.90	10.25	...	...	1.90	2.55	3.00	do.
1593	do	♀	...	...	2.99	13.00	...	...	...	...	3.05	do.
3636	Fort Tejon, Cal.	♂	1.25	2.25	...	16.00	0.65	1.50	1.40	2.75	2.50	do.

\* Specimens from Museum of Comparative Zoology, Cambridge, Mass.



TABLE XLIII.—Measurements of skulls of *LEPUS TROWBRIDGEI*.

Catalogue-number.	Original number.	Locality.	Total length.	Greatest width.	Distance between orbits.	Nasal bones, length.	Nasal bones, width behind.	Nasal bones, width before.	Upper incisors from front to molars.	Upper incisors from front to hinder margin of palate.	Upper incisors, height.	Upper incisors, width between external edges.	Upper molars, length taken together.	Upper molars, distance between.	Lower jaw, length.	Lower jaw, height.
4905	4163	Fort Crook, Cal.	9.55	1.39	0.67	1.09	0.59	0.44	0.75	1.07	0.30	.....	0.47	0.33	1.70	1.15
1971	.....	San Francisco, Cal.	9.45	1.05	0.55	1.17	0.40	0.36	0.75	1.04	0.25	0.91	0.46	0.35	.....	.....
1235	.....	do	.....	.....	0.57	1.19	0.47	0.44	0.65	1.07	0.94	0.94	0.47	0.34	1.73	1.10
1906	.....	do	.....	.....	0.54	1.05	0.47	0.44	0.60	1.00	0.25	0.91	.....	0.35	1.70	1.08
3566	3638	Fort Tejon, Cal.	9.55	1.05	0.66	1.03	0.50	0.44	0.77	1.03	0.97	0.93	0.45	0.36	1.67	1.09
3592	3631	do	.....	1.20	0.55	.....	0.40	.....	0.73	0.97	.....	.....	0.47	0.35	1.52	1.04
4921	.....	Cape St. Lucas, L. Cal.	9.18	1.15	0.55	0.90	0.40	0.36	0.65	0.94	0.23	0.16	0.40	0.37	1.49	1.03
4940	.....	do	9.30	.....	0.61	0.97	0.45	0.40	0.70	0.99	0.23	0.50	0.43	0.34	.....	.....
4941	.....	do	9.37	1.15	0.57	0.96	0.43	0.36	0.74	0.93	0.96	0.19	0.45	0.37	1.50	1.04
4144	.....	do	9.30	1.20	0.65	0.99	0.45	0.40	0.70	0.90	0.24	0.16	0.42	0.35	1.52	1.05

TABLE XLIV.—List of specimens of *LEPUS TROWBRIDGEI*.

Catalogue-number of skin.	Catalogue-number of skull.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
1871	.....	.....	San Francisco, Cal.	.....	Lt. W. P. Trowbridge	Lt. W. P. Trowbridge	Skull.
.....	1879	.....	do	.....	do	do	do
2585	.....	.....	do	.....	Mrs. Comp. Zoll	A. Agassiz	Alcoholic.
2586	.....	.....	do	.....	do	do	do
705	.....	.....	do	.....	Lt. W. P. Trowbridge	Lt. W. P. Trowbridge	Skin.
706	.....	.....	do	.....	do	do	do
707	.....	.....	do	.....	do	do	do
1171	.....	.....	do	.....	Lieutenant Williamson	Dr. Newberry	do
.....	1609	.....	do	.....	Lt. W. P. Trowbridge	Lt. W. P. Trowbridge	Skull.
310	1225	.....	San Francisco or Monterey, Cal.	.....	do	do	Skin and skull.
311	.....	.....	do	.....	do	do	Skin.
319	.....	.....	do	.....	do	do	do
669	.....	.....	Bodega, Cal.	.....	do	T. A. Ssabo	do
1163	.....	.....	Santa Clara, Cal.	.....	Dr. J. G. Cooper	Dr. J. G. Cooper	do
2974	.....	.....	Petaluma, Cal.	.....	E. Samuels	E. Samuels	do
2975	.....	.....	do	.....	do	do	do
1500	.....	♂	San Diego, Cal.	Mar. —, 1856	Dr. J. F. Hammond	Dr. J. F. Hammond	do
1502	.....	♀	do	Feb. 12, 1856	do	do	do
1503	.....	♀	do	Feb. 27, 1856	do	do	do
3631	3598	.....	Fort Tejon, Cal.	.....	J. Kantna	J. Kantna	Skin and skull.
3636	3598	♂	do	.....	do	do	do
.....	4921	.....	Cape Saint Lucas, Cal.	.....	do	do	Skull.
.....	4940	.....	do	.....	do	do	do
.....	4941	.....	do	.....	do	do	do
.....	4944	.....	do	.....	do	do	do
5019	.....	.....	do	May —, 1859	do	do	Skin.
5011	.....	.....	San José, Cal.	Apr. —, 1859	do	do	do
.....	.....	♀	Santa Barbara, Cal.	June 26, 1873	Lt. G. M. Wheeler	H. W. Henshaw	do

\* Specimens from the Museum of Comparative Zoölogy, Cambridge, Mass.

LEPUS GRAYSONI, *nov. sp.*

## Grayson's Hare.

General color above pale rufous or dull cinnamon-brown, varied with blackish-brown; below whitish. Upper surface of the head ferrugineous, finely mixed with black, fading anteriorly to paler rufous; sides of muzzle yellowish-brown; sides of the head pale fulvous-brown, below and behind the eye sparsely varied with black, a narrow pale ring around the eye, not more conspicuous than in *L. sylvaticus*; nape rufous. Ears covered with very short hair, looking nearly naked, yellowish-brown mixed with black anteriorly, at the base passing into blackish-brown, varied with yellowish-brown toward the tip; anterior margin whitish-edged till near the tip, where it is margined with blackish; posterior surface of the ears lighter and nearly naked. Dorsal region nearly uniformly pale reddish or cinnamon-brown, varied with blackish-brown, becoming paler and with fewer blackish hairs on the sides of the body and over the rump. Tail above blackish-brown, shading into the color of the rump; *white below*. Chin and sides of the lower jaw nearly white, passing into brown on the throat. Fore neck uniform reddish-brown. Middle of the lower surface of the body from between the fore legs to the tail whitish. Outer surface of limbs reddish-brown; inner surface whitish; upper surface of hind feet varied with pale rufous and whitish. Size and proportions same as in average specimens of *L. sylvaticus*. Feet small; nails naked.

This species is based mainly on a specimen collected at the Tres Marias Islands by the late Col. A. J. Grayson. It is of about the size of *Lepus sylvaticus*, but differs in many important features from any of the varieties of the *L. sylvaticus* group. The form of the postorbital processes shows that in this respect its affinities are with this group rather than with the Aquatic Hares (*L. palustris* and *L. aquaticus*), although its feet are small and as sparsely haired as in *L. palustris*. In general color and in some other features, it somewhat resembles *L. brasiliensis*, but is in other respects quite different. It has a tail as short as *L. townsendi*.

A second specimen, from Talamanca, Costa Rica, collected by J. Carmiol, is also referred to this species. It agrees with the Tres Marias specimen in size, proportions, and all essential particulars, but it is somewhat paler-colored. The pelage is rather harsher, and is evidently much worn, so that the paler color may be in part due to fading, or to seasonal difference.

TABLE XLV.—Measurements of *LEPUS GRAYSONI*.

Catalogue number.	Original number.	Locality.	Sex.	From tip of nose to—				Tail to end of—		Length of—		Height of ear.	Collected by—
				Eye.	Ear.	Occiput.	Tail.	Vertebra.	Hairs.	Fore feet.	Hind feet.		
8318	135	Tres Marias Islands	♀	1.63	2.90	3.25	14.50	0.75	.....	1.50	3.40	2.40	A. J. Grayson.
11400		Talamancas, Costa Rica		1.65	2.90	3.25		1.90	1.90	1.75	3.60	2.90	J. Carmichael.

**LEPUS BRASILIENSIS Linn.****Brasilian Hare; Tapeti.**

*Lepus brasiliensis* BRISSON, Reg. Anim., 1766, 141.—LINNÆUS, Syst. Nat., 12th ed., i, 1766, 78.—ERZLEBEN Syst. Reg. Anim., 1777, 336.—GMELIN, Syst. Nat., i, 1788, 164.—SCHREBER, Säuget., iv, 1792, 902.—SHAW, Gen. Zool., ii, 1801, 208.—AZARA, Paraguay, ii, 1801, 57.—DESMAREST, Mammalogie, 1822, 351.—MAXIMILIAN, Beiträge z. Naturg. Bras., ii, 1826, 450.—FISCHER, Synop. Mam., 1829, 375.—TSCHUDI, Fauna Peruana, i, 1844, 198.—WAGNER, Schreber's Säuget., Suppl., iv, 1844, 116.—WATERHOUSE, Nat. Hist. Mam., ii, 1848, 141.—GIEBEL, Säuget., 1855, 450.—FRANTZIUS, Wiegand. Arch., 1860, i, 276 (Costa Rica).—HENCKEL, Abhand. d. phys. Klasse d. königl. Akad. d. Wissenschaften zu Berlin, 1872, 68 (Southern Brazil).—ALLEN, Proc. Bost. Soc. Nat. Hist., xvii, 1875, 435.

*Lepus tapeti* FALLAS, Nov. Sp. Glires, 1778, 30.—ZIMMERMANN, Geograph. Gesch., ii, 1780, 334.

*Tapeti brasiliensis* GRAY, Ann. and Mag. Nat. Hist., 3d ser., xx, 1867, 284.

"*Tapeti brasiliensis*, MARCGRABE, Brazil, 223."

About the size of *Lepus sylvaticus*, or a little smaller; ears rather longer than in that species, and the tail shorter. Fur rather short and harsh; feet rather sparsely clothed, above yellowish-brown, varied with black, not very different in coloration from *Lepus palustris*; sides of the nose, orbital ring, throat, and abdomen white; legs and nape-patch bright rufous, the latter whitish on the inner side. Tail brown above, *rufous yellow below*.

Of this species I have very few specimens, and am hence unable to give much original information respecting it. Its reputed range extends throughout the greater part of South America, from Paraguay northward to Central America. With such a wide range, it would be surprising if it preserved everywhere uniform characters.

Waterhouse refers to two specimens from Bolivia, one of which, "an extremely young specimen," differs from the other in being blacker, and in having the rufous of the limbs, nape-patch, etc., of a brighter tint; in other words, having the colors much more intense. A half grown and rather faded specimen in the present collection from "Vermeto", Paraguay (the only one I have from South America), is not very appreciably different in color from ordinary specimens of *L. palustris*, though rather paler. The ears, however, are longer, and the tail shorter, the latter rufous-yellow below instead of white. A specimen from Chiriqui and two others from Costa

Rica (one of them quite immature) are much more yellow above than the Parana specimen, the general color above being yellowish-rufous mixed with black. The ears are also fully one-fourth shorter than in the Parana specimen, and considerably shorter than the measurements given by Waterhouse. The differences are so striking that at first I was inclined to regard the Costa Rican specimens as specifically distinct from the South American *L. brasiliensis*, and I propose finally to treat them as varietally distinct, under the subspecific designation of *gabbi*, which may be characterized as follows:

## LEPUS BRASILIENSIS var. GABBI.

## Central American Hare.

Size of *Lepus townsendi*; ears very short; tail rudimentary. Above pale cinnamon-brown, strongly varied with blackish. Whole upper surface of the head bright yellowish-ferruginous mixed with black. Nape pale rufous. A conspicuous, large, whitish spot below and behind the nostril, bordered by yellowish-brown, which latter color extends over the sides of the head, where it is varied with black. Chin and space over the rami of the lower jaw white. Fore neck pale yellowish-brown; rest of lower parts white. Ears anteriorly varied with pale rufous and black, with a narrow whitish border; ears nearly naked posteriorly. Limbs strongly rufous externally, inside much paler and more or less varied with white. Tail like the back above, yellowish-brown below.

The most striking peculiarity of this form is the shortness of the ears, which are much shorter than in any other species of *Lepus* with which I am acquainted. In size, it seems to be fully as small as *L. townsendi*. The specimens are all more or less mutilated, so that the character of the tail cannot be well determined. The *Lepus brasiliensis* of von Frantzius, from Costa Rica, doubtless refers to this variety.

TABLE XLVI.—Measurements of LEPUS BRASILIENSIS (including var. GABBI).

Catalogue number.	Original number.	Locality.	Sex.	From tip of nose to—					Length of—			Remarks.
				Eye.	Ear.	Occiput.	Tail.	Tail to end of hairs.	Fore foot.	Hind foot.	Height of ear.	
.....	.....	Bolivia .....	.....	2.50	.....	13.00	1.85	.....	2.90	2.00	.....	From Waterhouse.
.....	.....	Para. ....	.....	2.50	.....	15.00	.....	.....	3.00	2.00	.....	do.
.....	.....	Vermelo, Paraguay .....	.....	2.30	.....	.....	.....	.....	2.75	2.25	.....	
8140	.....	Chiriqui, Central America .....	.....	1.30	2.25	2.00	.....	.....	1.30	2.00	1.65	
11371	18	Talamancas, Costa Rica .....	♂	1.60	2.00	2.90	.....	.....	1.33	2.95	1.45	

TABLE XLVII.—Measurements of skulls of *LEPUS BRASILIENSIS*.

Locality.	Total length.	Greatest width.	Distance between orbits.	Nasal bones, length.	Nasal bones, width behind.	Nasal bones, width below.	Upper incisors from front to hinder margin of palates.	Upper molars, length taken together.	Lower jaw, length.	Remarks.
Bolivia.....	2.55	1.83	0.63	1.00	0.50	0.33	0.95	0.50	1.98	From Waterhouse.
Para.....	2.90	1.25	0.68	0.97	0.50	0.34	0.98	0.50	1.98	.....do.

TABLE XLVIII.—List of specimens of *LEPUS BRASILIENSIS* (including var. *GABBII*).

Catalogue-number.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Nature of specimen.
4053.....	.....	.....	"Vermeto", Paraguay.....	.....	Capt. T. J. Page.....	Skin.
8140.....	.....	.....	Chiriqui, Central America.....	1863	Fred. Hinks.....	do.
11371 18 ♂	.....	.....	Talamanca, Costa Rica.....	.....	W. M. Gabb.....	do.
11372 10 ♂	.....	.....	.....do.....	.....	.....do.....	do.

## LEPUS CALLOTIS Wagler.

## Var. CALLOTIS.

## Mexican Hare; Southern Jackass Hare.

*Lepus callotis* WAGLER, Nat. Syst. Amphib., 1830, 35; Ids., 1831, 511.—WAGNER, Schreber's Säuget., iv, pl. cccxxiii E; Suppl., iv, 1844, 106.—WATERHOUSE, Nat. Hist. Mam., ii, 1848, 138.—AUD. & BACH., Quad. N. Amer., ii, 1851, 56, pl. lxiii.—WOODHOUSE, Sitgreaves's Col. and Zuni River Exped., 1853, 55.—GIBBS, Säuget., 1855, 449.—BAIRD, Mam. N. Amer., 1857, 590, pl. lvii, fig. 1, skull (in part only); U. S. and Mex. Bound. Survey, ii, ii, 1859, 45, pl. xxv, fig. 1 (skull).—SAUSSURE, Rev. et. Mag. Zool., 1860, 56 (Province of Michoacan).—GRAY, Ann. and Mag. Nat. Hist., 3d ser., x, 1867, 224 (in part only).—ALLEN, Proc. Bost. Soc. Nat. Hist., xvii, 1875, 435 (in part only).

*Lepus nigricaudatus* BENNETT, Proc. Zool. Soc. Lond., i, 1833, 41.—BACHMAN, Jour. Acad. Nat. Sci. Phila., viii, 1839, 84.

"*Lepus mexicanus* LIGHT." RICHARDSON, Sixth Rep. British Am. (1836), 1837, 150, 158.

*Lepus callotis* var. *nigricaudatus* WAGNER, Suppl. Schreber's Säuget., iv, 1844, 107.

*Lepus callotis* var. *flavicularis* WAGNER, Suppl. Schreber's Säuget., iv, 1844, 107.

*Lepus texianus* AUD. & BACH., Quad. N. Amer., iii, 1853, 186, pl. cxxxiii.

## Var. TEXIANUS.

## Northern Jackass Hare.

*Lepus texianus* WATERHOUSE, Nat. Hist. Mam., ii, 136, 1848 (not of Aud. and Bach.).

*Lepus callotis* BAIRD, Mam. N. Amer., 590, 1857 (in part only).—KENNERLY, Pacific R. R. Expl. and Surveys, x, vi, 16, 1859 (Fort Conrad, N. M.).—BUCKLEY, Pacific R. R. Expl. and Surveys, xii, iii, 104, 1860 (Boise River, Oregon).—BUCKLEY & GIBBS, ibid., 131.—COORS, Am. Nat., i, 531, 1867 (Arizona); Proc. Acad. Nat. Sci. Phila., 1867, 136.—COOPER, Am. Nat., iii, 470, 1860 (Colorado Valley).—MERRIAM, Hayden's U. S. Geol. Survey, Sixth Ann. Rep., 666, 1873 (Ordan, Utah).—ALLEN, Bull. Essex Institute, vi, 53, 66, 1874 (Wyoming and Salt Lake Valley).

Var. *TEXIANUS*.*Northern Jackass Hare.*

Above pale ashy-gray, sometimes tinged with brownish and mixed with black. Below white, or nearly white on the middle of the belly, passing into grayish-white or very pale brownish-white on the sides, the inside of the limbs, and on the breast, where it is more strongly brownish. Throat lighter, nearly white. Orbital ring white, varying to yellowish-white. Ears more or less broadly tipped with black, yellowish-brown (externally), mixed with black on the anterior half, whitish on the posterior half, passing into white at the base; fringe of the borders yellowish-white. Tail black above, the black extending forward upon the rump, very much as in *L. californicus*; sides and below gray.

This species presents considerable variations in color, and in the fullness and softness of the fur, with the season. The above description applies more especially to fall and winter specimens, in which the pelage is very full, long, and soft, and in which the feet are well clothed. In summer specimens, the fur of the body is shorter, and the feet and legs are more sparsely clothed. The brownish tint of the back is perhaps rather stronger, and the limbs are of a more decided gray; the lower surface, except the breast, is generally pure white. One of the most marked seasonal differences in color, however, consists in the color of the nape-patch, which in winter specimens differs but little in tint from the general color of the upper surface, and over which the fur is long and soft, gray externally, and black at the base. In summer specimens, the fur of the nape-patch is short and generally intense black, owing, in part at least, to the shedding or wearing-off of the longer gray outer covering of winter.

Specimens collected at the same season vary in respect to the amount of black in the dorsal surface and in the strength of the pale fulvous shade.

Var. *CALLOTIS*.*Mexican Hare; Southern Jackass Hare.*

Slightly smaller than var. *texianus*, with the black on the tips of the ears nearly or quite obsolete, being replaced with pale yellowish or pure white. Above more or less strongly yellowish-brown, mixed with black; lower surface, including the limbs and sides of the rump, white, usually finely

mixed with black, especially on the limbs; breast pale yellowish, varying to bright fulvous.

A specimen from Tehuantepec (No. 9430), collected December 3, is the most highly-colored of any in the collection, and agrees perfectly with Wagner's description of his variety *flavigularis*. In this, the color above is bright yellowish-brown, strongly variegated with black. The neck in front and the breast are strongly yellowish-brown, which color extends forward on either side of the throat and along the sides of the body. The rest of the lower parts are pure white; the legs are of a pure, rather dark, gray, which color, rather more mixed with black, extends over the thighs and the sides of the rump. The fur is everywhere very short and rather harsh, as compared with winter specimens of var. *texianus*; the pelage of the legs is especially short, so that these parts look very small and slender.

Summer specimens from Southern Texas (Nos. 252, 241, 134, etc.) present the same general features of short, rather harsh, pelage, very scantily-clothed legs and feet, and brighter and purer colors; but the fulvous tint, especially over the fore neck and breast, is of a much more brownish cast. A specimen from Orizaba, Mexico, quite closely resembles, in the color of the dorsal surface, the specimens from Texas, but the brownish tint of the breast and sides of the body is nearly obsolete, the whole lower surface of the body being almost uniformly pure white. A striking feature in this specimen, remarkable for the general lightness of its colors, is the terminal *white* patch on the ears.

Considering the varieties in their co-specific relationship, we find that the Texan and Mexican specimens are much more strongly colored, especially in respect to the fulvous tint, than specimens of the more northern type, while the palest specimens come from Arizona and Utah. A specimen from Boisé River, Oregon, is varied with black and gray above, with only a very faint tinge of brownish on the limbs, sides, and breast.

The black at the tip of the ear varies from a patch an inch or more in length to a narrow terminal bordering, and is sometimes wholly obsolete. It is narrower in Texas specimens than in those from Arizona and Utah, existing in some of the former only as a very narrow border, while in the specimens from Mexico it is wholly absent, being replaced in one by white and in the other by fulvous.

The extremes in respect to variation in color, as indicated in the varietal diagnoses, present very wide differences, but there are so many intervening

stages that the passage from the one to the other is by very gradual steps. Thus the general aspect above of specimens from Utah is grayish-white, with the faintest tinge of brownish, strongly mixed with black, with a black spot at the tip of the ear an inch or more in length. The specimens from Texas and Orizaba, on the other hand, are strongly washed above with fulvous, with the black ear-spot greatly reduced or wholly obsolete. In the Tehuantepec specimen, the fulvous culminates in a quite intense yellowish-brown.

The general size varies, as usual, very considerably in different individuals. Taking the size of the skull as the most convenient standard of comparison, we find the extremes of variation in a series of eight adult specimens to be, length, 3.37 to 4.08; width, 1.63 to 1.82. The ears vary in length in different specimens from 4.50 to 6.00, the largest-eared examples coming generally from the most southern localities.

*General remarks.*

**SYNONYMY.**—The variations in color already described have given rise to several synonyms. The species was first described by Wagler in 1830, from specimens collected in Mexico, under the name *Lepus callotis*. In 1833, Mr. Bennett redescribed it from specimens said to have come from "California", but which doubtless came from Western Mexico, under the name *Lepus nigricaudatus*. In 1836, Richardson referred undoubtedly to this species, under what seems to have been a MS. name of Lichtenstein's in the Berlin Museum, as "*Lepus mexicanus* Licht."\* Wagner, in 1844, redescribed the species from Mexican specimens, recognizing three varieties from Mexico, viz, var. I. *L. callotis*; var. II. *L. nigricaudatus*; var. III. *L. flavigularis*, all based on specimens from Mexico. The differences consist in variations of color, the variety named *flavigularis* apparently closely resembling the above-described example from Tehuantepec. In 1848, Waterhouse described a specimen, from an unknown locality, with black tips to the ears, as presumably the *Lepus texianus* of Audubon and Bachman, on the identification of the specimen by Mr. J. W. Audubon. In 1853, Audubon and Bachman described a *Lepus texianus* as the common "Jackass Rabbit" of Texas, but without any allusion to Waterhouse's provisional description of a species under the same name. Audubon and Bachman do not mention the ears as having black tips,

\* Respecting this name, Waterhouse observes: "The brief note relating to the *L. mexicanus* of the Berlin Museum, furnished me by Dr. Bachman, describes that animal as having the back of the neck black; the white of the under parts of the body extending high upon the flanks, and, indeed, in all other respects agreeing with the characters of *L. callotis*." *Nat. Hist. Mem.*, II, 141.



but refer to one specimen as having the margin of the ear brown. These and other slight discrepancies are noted by Baird, who, in 1857, doubtfully referred the *Lepus texianus* of Waterhouse to *L. callotis*, but left the *L. texianus* of Audubon and Bachman in his list of those his material did not allow him to satisfactorily discuss.

It will be noticed that in the descriptions accompanying the above-cited names the black spot at the tip of the ear, which is so constant in specimens from the United States, is not mentioned except in Waterhouse's description of his "*Lepus texianus*?", and that the other features of coloration apply strictly to the Mexican specimens, and in less degree to those from Texas, but not at all to specimens from the Territories of Arizona, Nevada, Utah, Oregon, and Wyoming. Professor Baird very distinctly referred to the differences presented by specimens from the northward as compared with those from Texas and Mexico, and thought it possible the form from the more northern localities in the United States might prove to be a distinct species, at the same time calling attention to the complete gradation by easy stages from the one extreme to the other. Although this gradation is unquestionable the constancy of the very considerable differences between the northern and southern forms seems to warrant their differentiation as geographical races. Waterhouse's description clearly refers to the northern type, which he describes as having the fur "long and soft, the general hue of the animal pale, inclining to ashy-gray, but strongly mottled with black and brownish-white", "the ears with a large black patch at the apex externally", etc., and hence his name, notwithstanding its unfortunate geographical allusion, is unquestionably applicable to the northern type, while Texas specimens, especially those from near the Mexican border, present an intermediate phase more strongly resembling the southern than the northern type.

*Lepus callotis* finds its nearest ally in *L. californicus*, but differs from it so considerably in color and in other respects (as will be pointed out under the head of *L. californicus*) as to be readily distinguishable from it. From *L. campestris*, which agrees with it quite nearly in size, and also resembles it considerably in color, it is easily separable, as already shown in the discussion of that species; *L. campestris* differing from *L. callotis* in its shorter ears, in wanting the black on the tail, and in becoming white in winter.

GEOGRAPHICAL DISTRIBUTION.—The habitat of *Lepus callotis* var. *texianus* may be given as extending from Southeastern Oregon southward to Mexico, and from the Sierra Nevada Mountains eastward to near the eastern border

of the plains east of the Rocky Mountains. Dr. Cooper gives its western limit in latitude  $35^{\circ}$  as the Colorado River. I have observed it on the plains of Western Nebraska and Middle Kansas; and there are specimens in the collection from as far east as Austin, Texas. It does not appear to overlap the range of *Lepus californicus*, but extends over the southern half of the range of *Lepus campestris*. Toward the Mexican border, especially in Texas, it begins to very generally take on the distinctive features of variety *callotis*.

The habitat of *Lepus callotis* var. *callotis* extends from about the southern boundary of the United States far southward into Mexico, there being specimens in the collection from Orizaba and Tehuantepec; and De Saussure mentions it as being common in the province of "Mechoacan", in about latitude  $19^{\circ}$ .

TABLE XLIX.—Measurements of *LEPUS CALLOTIS*.

Catalogue-number of skin.	Locality.	Sex.	From tip of nose to—			Tail to end of—		Length of—		Height of ear.	Remarks.
			Ear.	Occip.	Tail.	Verteb.	Hairs.	Fore foot.	Hind foot.		
454	Boisé River, Oregon Ter.	♂	.....	.....	28.56	.....	.....	1.70	4.40	4.96	From haird.
590	Chasco Bocondido, Mexico	.....	4.06	.....	19.75	2.25	3.25	5.17	4.58	5.07	...do.
134	Eagle Pass, Tex.	.....	3.53	4.00	19.50	.....	.....	5.17	4.58	4.50	...do.
135	.....do.	.....	4.25	4.80	24.50	1.75	2.53	5.23	4.58	5.07	...do.
593	Brasos de Santiago, Tex.	.....	4.00	4.83	21.75	1.88	2.75	5.25	4.00	4.75	...do.
301	West of San Antonio, Tex.	.....	4.17	4.55	20.50	3.08	4.08	5.03	4.50	5.00	...do.
9066	Llano Estacado, Tex.	.....	3.30	.....	19.00	.....	.....	.....	4.95	5.22	...do.
1791	Pecos River	♀	5.00	.....	24.00	.....	.....	5.05	5.05	5.95	...do.
1798	.....do.	.....	4.60	.....	26.00	.....	.....	5.38	4.88	5.95	...do.
346	Fort Conrad, N. Mex.	.....	4.45	.....	17.50	.....	.....	5.20	.....	5.95	...do.

TABLE L.—Measurements of skulls of *LEPUS CALLOTIS* (including var. *TEXIANUS* and *CALLOTIS*).

Catalogue-number.	Original number.	Locality.	Total length.	Greatest width.	Distance between orbits.	Max. basen. length.	Max. basen. width behind.	Max. basen. width before.	Upper incisors from front to molars.	Upper incisors from front to hinder margin of palates.	Upper incisors height.	Upper incisors, width between external edges.	Upper molars, length taken together.	Upper molars, distance between.	Lower jaw length.	Lower jaw height.
7030	.....	Texas.	3.93	1.75	0.90	1.77	0.95	0.80	1.22	1.57	.....	.....	0.65	0.55	2.65	1.35
1815	.....	.....	3.70	1.73	0.80	1.50	0.83	0.70	1.12	1.45	0.37	0.33	0.63	0.58	2.60	1.40
76506	.....	.....do.	4.08	1.75	0.87	1.98	0.98	0.88	1.37	1.77	0.34	0.34	0.73	0.54	2.98	1.92
7406	.....	.....do.	3.25	1.22	0.87	1.75	0.87	.....	1.22	1.60	0.42	0.35	0.70	0.57	.....	.....
*1118	.....	Eagle Pass, Tex.	3.27	1.63	0.85	1.50	0.87	.....	1.10	1.37	.....	.....	0.60	0.47	2.50	.....
11774	.....	.....	4.05	1.70	0.98	1.98	0.90	0.74	1.36	1.88	0.50	0.35	0.63	0.57	2.83	1.92
8633	.....	Tehuantepec, Mex.	3.86	1.80	0.90	1.70	0.85	0.80	1.15	1.67	0.46	0.34	0.67	0.52	2.70	1.90
6908	9430	.....do.	3.27	1.22	0.94	1.75	0.87	0.84	1.23	1.70	0.38	0.35	0.67	0.55	2.85	1.88
1980	.....	Fort Conrad, N. M.	3.80	1.75	0.75	1.65	0.86	0.74	1.24	1.60	0.40	0.35	0.60	0.50	2.50	1.60

\* Rather young.

TABLE LI.—List of specimens of *LEPUS CALLOTIS* (including *vars.* *TEXIANUS* and *CALLOTIS*).

Catalogue number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
454	.....	87	...	Bolné River, Oregon T.	Sept. 27, 1854	Gov. I. I. Stevens...	Dr. George Buckley	Skin.
455	.....	98	...	do	Sept. —, 1854	do	do	do.
3994	.....	...	...	Fort Bridger, Utah	.....	.....	C. S. McCarthy	do.
9316	.....	96	...	Camp 95	.....	Clarence King	Robert Ridgway	do.
.....	.....	1376	...	Ogden, Utah	Sept. 26, 1871	Mus. Comp. Zoology	Allen & Bennett	do.
11340	.....	389	♀	Beaver, Utah	Nov. 10, 1879	Lieut. G. M. Wheeler	Henshaw & Yarrow	do.
8476	.....	1068	♂	Fort Whipple, Ariz.	Nov. 15, 1864	Dr. E. Coues	Dr. E. Coues	do.
8477	.....	1498	♀	do	Mar. 7, 1863	do	do	do.
7816	.....	748	♂	do	Sept. 17, 1864	do	do	do.
7815	.....	701	♂	do	Sept. 3, 1864	do	do	do.
346	1300	.....	...	Fort Conrad, N. Mex.	.....	.....	Dr. C. B. R. Kennerly	Skin and skull.
11878	.....	693	♀	San Pedro, Ariz.	Sept. 3, 1873	Lieut. G. M. Wheeler	H. W. Henshaw	Skin.
8904	.....	♂	...	Camp Grant, Ariz.	Feb. 20, 1867	Dr. E. Palmer	Dr. E. Palmer	do.
134	1118	.....	...	Eagle Pass, Tex.	Apr. —, 1859	Maj. W. H. Emory	A. Schott	Skin and skull.
135	1119	.....	...	Rio Bravo del Norte	Summer, 1859	do	do	do.
9998	.....	.....	...	Llano Estacado, Tex.	.....	Capt. J. Pope	do	Skin.
2969	.....	0	...	do	.....	do	do	do.
.....	7630	.....	...	Texas	.....	.....	do	Skull.
.....	7630bis	.....	...	do	.....	.....	do	do.
853	1191	.....	...	Branco, Tex.	Autumn, 1858	G. Wüdemann	G. Wüdemann	Skin and skull.
450	.....	0	...	Red River, Tex.	.....	Cap. G. B. McClellan	.....	Skin.
361	1915	.....	...	Western Tex.	.....	Lieut. D. N. Couch	J. H. Clark	Skin and skull.
308	1916	.....	...	do	.....	do	do	do.
300	.....	.....	...	do	.....	do	do	Skin.
8577	.....	241	...	Laredo, Texas	June 9, 1866	Dr. H. B. Butcher	Dr. H. B. Butcher	do.
1730	.....	.....	...	Devil's River, Tex.	May 3, 1855	Capt. J. Pope	.....	do.
1729	.....	.....	...	Western Texas	.....	do	do	do.
1791	.....	.....	...	do	.....	do	do	do.
1798	.....	87	0	Rio Pecos, Tex.	.....	do	do	do.
859	.....	.....	...	Austin, Tex.	.....	S. K. Jennings	S. K. Jennings	do.
5840	.....	.....	...	Rio Grande, Tex.	.....	L. Sitgreaves	Dr. S. W. Woodhouse	do.
5839	.....	.....	...	Red Fork of Arkansas	.....	.....	.....	do.
118	.....	.....	...	Red River (Ark. ?)	.....	.....	.....	do.
579	.....	.....	...	Charco Escondido, Mex.	.....	Lieut. D. N. Couch	.....	do.
8561	.....	.....	...	Orizaba, Mexico	.....	Prof. F. Sumichrast	Prof. F. Sumichrast	do.
9430	8968	♀	...	Tehuantepec, Mexico	Dec. 3, 1869	do	do	Skin and skull.
.....	8653	.....	...	do	.....	do	do	Skull.
11774	.....	.....	...	(f)	.....	(f)	(f)	do.

## LEPUS CALIFORNICUS Gray.

## Californian Hare.

- Lepus californicus* GRAY, Charlesworth's Mag. Nat. Hist., i, 1837, 586; Proc. Zool. Soc. Lond., iv, 1839, 88 (name only, without a description).—BACHMAN, Journ. Acad. Nat. Sci. Phila., viii, 1839, 86 (description of Gray's original specimen).—WAGNER, Suppl. Schreber's Säuget., iv, 1844, 110 (from Bachman).—WATERHOUSE, Nat. Hist. Mem., ii, 1848, 131 (redescription of Gray's and Bachman's specimens).—AUD. & BACH., Quad. N. Am., iii, 1853, 53, pl. cxlii.—GIEBEL, Säuget., 1855, 460.—BAIRD, Mam. N. Am., 1857, 604, pl. lvii, fig. 2 (skull); U. S. and Mex. Bound. Survey, ii, ii, 1859, 47 (Lower Colorado River, Col.).—NEWBERRY, Pacific R. R. Ex. & Surv., vi, iv, 1857, 63.—COOPER, Am. Nat., iii, 1869, 470.—SUCKLEY, Pacific R. R. Ex. & Surv., xii, iii, 1869, 104.—SUCKLEY & GIBBS, ibid., 132.—GRAY, Ann. & Mag. Nat. Hist., 3d ser., xx, 1867, 224.—ALLEN, Proc. Bost. Soc. Nat. Hist., xvii, 1875, 435.
- Lepus richardsoni* BACHMAN, Journ. Acad. Nat. Sci. Phila., viii, 1839, 88.—(See also AUD. & BACH., Quad. N. Am., iii, 1853, 56.)—WAGNER, Suppl. Schreber's Säuget., iv, 1844, 111.
- Lepus bennettii* GRAY, Zool. Sulphur, 1844, 35, pl. xiv.

Of about the size of, or rather smaller than, *Lepus callotis*. Ears of about the same length as in that species, with the hind feet rather shorter. Above yellowish-brown, approaching reddish-brown, mixed with black. Below light cinnamon; lighter, approaching white, along the median line; more rufous on the chest, limbs, and sides, where the rufous becomes mixed with black. Nape fulvous. Anterior half of the ear pale blackish-brown, varied with fulvous; posterior half whitish, becoming white at the base; fringe of the borders light fulvous; tip of the ear black. Tail black above, the black extending forward in a broad line on to the rump; sides and below pale cinnamon-brown. Limbs exteriorly finely marked with black.

This species differs in color from *L. callotis* mainly in its stronger tints, the rufous throughout the pelage being much stronger, and the intermixed black hairs of the upper surface more abundant.

The color varies considerably in intensity in different individuals; specimens occasionally occurring nearly as pale as average specimens of *L. callotis*. At other times, the rufous tint becomes nearly as strong as in *Lepus europæus* (= *timidus* auct.) of the Old World. The amount and intensity of the black on the ears is also subject to considerable variation. The small white spot in the middle of the forehead, common to nearly all Hares when young, is generally distinctly traceable, as it is also in *L. callotis* and *L. campestris*.

The ear varies in length from 5.00 to 6.50, ranging generally between 5.50 and 6.00. The hind foot varies from 4.70 to 5.60, ranging generally between 5.00 and 5.40. The hind foot thus is generally considerably (about one-tenth) shorter than the ear. The length of the head is generally not more

than two-thirds of the length of the ear. The skull varies in length from 3.45 to 3.88; in breadth from 1.53 to 1.75. The lower jaw varies in length from 2.17 to 2.77.

The southern specimens are considerably smaller than the northern, as shown by the measurements given in the subjoined table. Thus the average length of five skulls from the vicinity of San Francisco is 3.80, width 1.72; while the average length of nine skulls from Cape Saint Lucas, Lower California is 3.52, width 1.58.

This species differs from *L. callotis*, its nearest ally, in being considerably smaller, in its darker and more rufous tints and relatively longer ears, and in the small size of the lower jaw, which is relatively smaller than that of any other North American species of *Lepus*.

This species was first indicated in 1837 by Dr. Gray, who mentioned it under the name *L. californicus*, without, however, publishing any description of the species. Two years later it was described from the same specimen by Dr. Bachman. Its only synonyms are *Lepus richardsoni* of Bachman (1838), based on a specimen supposed to have come from California, and *Lepus bennetti* of Gray.

GEOGRAPHICAL DISTRIBUTION.—The *Lepus californicus* ranges from the northern parts of California southward along the coast to Cape Saint Lucas. It seems to be mainly restricted to the region west of the Sierra Nevada Mountains; but in latitude 35°, according to Dr. J. G. Cooper, it extends eastward to the Colorado River. Further eastward, it is replaced by *L. callotis* var. *texianus*.

TABLE LII.—Measurements of *LEPUS CALIFORNICUS*.

Catalogue-number of skin.	Locality.	Sex.	From tip of nose to—				Tail to end of—		Length of—		Height of ear.	Remarks.
			Eye.	Ear.	Occip.	Tail.	Verteb.	Hairs.	Fore foot.	Hind foot.		
1169	Fort Reading, Cal. ....	♂	3.30	3.50	4.03	30.00	.....	.....	2.65	5.05	5.70	From Baird.
666	Bodega, Cal. ....	♂	3.40	4.75	4.90	25.00	.....	.....	3.38	5.30	5.08	.....do.
3276	Petaluma, Cal. ....	♂	3.33	4.10	4.75	.....	3.60	5.35	3.50	5.30	6.50	.....do.
1990	.....do. ....	♂	.....	.....	.....	22.00	3.30	4.70	3.55	3.60	5.40	.....do.
1168	San Francisco, Cal. ....	♂	3.35	.....	4.70	31.00	2.95	4.70	3.30	5.10	6.00	From Baird.
3065	San Diego, Cal. ....	♂	1.76	3.45	3.95	30.00	3.00	4.00	.....	4.70	5.10	.....do.
1595	.....do. ....	♂	1.50	3.10	3.40	15.00	1.28	2.38	1.90	3.63	3.35	.....do.
1327	Colorado Desert. ....	♂	1.78	3.45	3.95	30.00	3.00	4.00	.....	4.70	5.10	.....do.
9415	Cape St. Lucas, L. Cal. ....	♂	3.00	3.50	5.00	18.00	4.00	5.30	.....	5.30	6.30	Collector's measurements.

TABLE LIII.—Measurements of skulls of *LEPUS CALIFORNICUS*.

Catalogue-number of skull.	Corresponding number of skin.	Locality.	Sex.	Total length.	Greatest width.	Distance between orbits.	Nasal bones, length.	Nasal bones, width behind.	Nasal bones, width before.	Upper incisors from front to molars.	Upper incisors from front to hinder margin of palate.	Upper incisors, height.	Upper incisors, width between external edges.	Upper molars, length taken together.	Upper molars, distance between.	Lower jaw, length.	Lower jaw, height.
2971	.....	Petaluma, Cal.	.....	3.78	1.70	0.84	1.50	0.83	0.70	1.16	1.50	0.39	0.39	0.69	0.54	2.47	1.35
2972	.....	do	.....	3.85	1.70	0.80	1.57	0.78	0.80	1.27	1.54	0.37	0.33	0.67	0.50	2.65	1.55
2973	1416	do	.....	3.88	1.75	0.86	.....	0.86	.....	1.20	1.60	0.36	0.35	0.69	0.51	2.02	1.52
2974	.....	do	.....	3.55	1.70	0.75	1.45	0.75	.....	1.10	1.45	0.30	0.30	0.56	0.56	2.43	1.44
3296	3918	San Francisco, Cal.	.....	3.98	1.75	0.85	1.73	0.86	0.84	1.20	1.68	.....	.....	0.64	0.56	2.77	1.60
3511	3686	Ft. Tejon, Cal.	.....	3.60	1.64	0.86	1.50	0.70	0.70	1.15	1.50	0.38	0.33	0.58	0.55	2.45	1.45
4137	4918	Cape St. Lucas, L. Cal.	♂	3.65	1.55	0.74	1.45	0.75	0.70	1.19	1.44	0.40	0.37	0.60	0.45	2.45	1.48
4139	5175	do	.....	3.60	.....	0.78	1.47	0.78	0.70	1.10	1.45	0.40	0.33	0.60	0.45	.....	.....
4260	4116	do	.....	3.55	1.53	0.70	1.40	0.70	0.66	1.08	1.40	0.40	0.35	0.58	0.50	2.40	1.37
4265	.....	do	.....	3.45	1.55	0.67	1.35	0.67	0.60	1.05	1.40	0.38	0.35	0.55	0.45	2.37	1.40
4286	.....	do	♂	3.55	1.63	0.73	1.53	0.68	0.64	1.07	1.45	0.40	0.35	0.57	0.46	2.30	1.58
4287	.....	do	♂	3.45	1.55	0.77	1.35	0.78	0.68	1.05	1.35	0.42	0.36	0.60	0.46	2.17	1.40
4298	.....	do	.....	3.50	1.67	0.75	1.46	0.73	0.68	1.13	1.40	0.40	0.30	0.57	0.56	2.35	1.45
4299	.....	do	.....	3.57	1.54	0.76	1.40	0.67	0.66	1.15	1.45	0.38	0.32	0.62	0.45	2.30	1.45
4290	.....	do	.....	3.50	1.60	0.75	1.37	0.70	0.66	1.13	1.43	0.45	0.35	0.60	0.50	.....	.....
4331	.....	do	.....	3.47	1.57	0.68	1.45	0.67	0.66	1.08	1.36	0.40	0.33	0.57	0.43	2.25	1.42
7462	8894	Arizona	.....	3.55	1.60	0.75	1.45	0.75	0.74	1.12	1.48	0.40	0.35	0.62	0.50	2.57	1.62

\* Rather young.

† Molars,  $\frac{6-5}{5-5}$ ; last left upper molar undeveloped.

TABLE LIV.—List of specimens of *LEPUS CALIFORNICUS*.

Catalogue-number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimens.
9371				Petaluma, Cal.		E. Samuels	E. Samuels	Skull.
9373				do		do	do	do
1410	9373			do		do	do	Skin and skull.
9374				do		do	do	Skull.
9376				do		do	do	Skin.
9318	3295	334		San Francisco, Cal.		U. S. Expl. Exped.	Dr. W. Simpson	Skin and skull.
3385				do		do	do	Skin.
3696				Vallecita, Cal.		Dr. J. S. Newberry	Dr. J. S. Newberry	do
664				Bodega, Cal.		Lt. W. P. Trowbridge	T. A. Saabo	do
665				do		do	do	do
1097		70		Fort Jones, Cal.		do	Dr. G. Suckley	do
1669				Fort Reading, Cal.		Lt. E. S. Williamson	Dr. J. S. Newberry	do
9265				San Diego, Cal.		Lt. W. P. Trowbridge	A. Cassidy	do
5906		383	♂	Cape St. Lucas, L. Cal.		John Xantus	J. Xantus	do
5905		394	♂	do		do	do	do
5907		3974	♂	do	Feb. —, 1890	do	do	do
5910		1126	♂	do	June —, 1890	do	do	do
5841			♂	do	Apr. —, 1890	do	do	do
6415		4577	♂	do		do	do	do
4878	4137			do		do	do	Skin and skull.
9175	4139			do		do	do	do
4116	4280	521		do		do	do	do
	4285	620		do		do	do	Skull.
	4286	619		do		do	do	do
	4287	618		do		do	do	do
	4288	609		do		do	do	do
	4289	608		do		do	do	do
	4290	607		do		do	do	do
	4291	606		do		do	do	do
8694	7468			Arizona.		Dr. E. Palmer	Dr. E. Palmer	Skull and skin.
1327				Colorado Desert.		Maj. W. H. Emory	A. Schott	Skin.

*LEPUS PALUSTRIS* Bachman.

## Marsh Hare.

*Lepus palustris* BACHMAN, Journ. Acad. Nat. Sci. Phila., vii, 1837, 194, 336, pls. xv, xvi; viii, 1839, 70.—AUDUBON, Birds of America, iv, 510, pl. cccixii.—WATERHOUSE, Nat. Hist. Mam., ii, 1848, 119.—AUD. & BACH., Quad. N. Am., i, 1849, 151, pl. xviii.—BAIRD, Mam. N. Am., 1857, 615, pl. lix, fig. 2 (skull).—COUES, Proc. Bost. Soc. Nat. Hist., xlii, 1869, 86.—ALLEN, Bull. Mus. Comp. Zool., ii, 1871, 184; Proc. Bost. Soc. Nat. Hist., xvii, 1875, 435.

*Hydrolagus palustris* GRAY, Ann. and Mag. Nat. Hist., 3d ser., xx, 1837, 921.

*Lepus douglasii* var. 2, GRAY, Charlesworth's Mag. Nat. Hist., i, 1837, 586.

About the size of, or slightly larger than, the eastern form of *L. sylvaticus*, and of somewhat similar general proportions, but with much shorter tail, and broader, heavier incisors and molars, and much larger and stouter lower jaw; ears broader and more rounded; feet very sparsely furred, the

nails generally exposed. Above yellowish-brown, inclining to rufous, strongly shaded with black. Below grayish-white, generally nearly pure white on the middle of the belly, shading through gray into yellowish-brown on the sides and on the breast and fore neck; chin grayish-white, passing into darker and more brownish-gray on the throat. Sides of the rump, posterior and outer surface of the limbs, and nape-patch rufous. Ears exteriorly grayish-rufous and black. Tail beneath grayish-white, above rufous, varied with black. Fur coarse and bristly, especially in winter.

In size, general coloration, and proportions, this species is nearer the southern form of the eastern variety of *Lepus sylvaticus* than any other; but the pelage is more rufous above and less white below; the rufous tint also covers the anterior surface of the hind limbs, which in *L. sylvaticus* are whitish. The absence of any light edging to the ears, the very short tail, not conspicuously white or "cottony" below, the rusty instead of gray rump, and the sparsely-clothed feet and exposed nails further serve to readily distinguish it. The black, bristly hairs of the dorsal surface are also more abundant, coarser, and stiffer. The differences in the skulls of the two species are more marked, that of *L. palustris* being relatively larger and heavier, with a very much larger lower jaw, broader incisors, and stouter molars, and having the postorbital processes solidly ankylosed with the skull. Its small size, different coloration, etc., serve to at once separate it from *L. aquaticus*.

The variation in coloration in different specimens is very considerable, but relates almost wholly to the intensity of the tints. In some, the brownish color of the upper parts, sides of the body, and limbs is much more intense in some specimens than in others. There is also a similar variation in respect to the black of the dorsal surface, which very much more predominates over the brownish ground-color in some individuals than in others, even among those from the same locality. By far the most highly-colored specimen is one from Mirador (near Vera Cruz), Mexico, in which the black is considerably more prevalent than in average specimens from the Atlantic States. The grayish area below is also more restricted and more suffused with brownish.

The skull presents the usual amount of variation in size in different individuals, the extremes in a series of twelve specimens from Saint Simon's Island, Georgia, being as follows: Length, 3.00 to 3.20; breadth, 1.40 to 1.57.



The specimens being chiefly from Georgia, they give but little information in respect to geographical variation in size or color.

The species was first described by Bachman in 1837, and its only synonym is *Lepus douglassi* var. 2 of Gray, of nearly the same date. In addition to the subsequent accounts of this species by Waterhouse, Audubon and Bachman, and Baird, Dr. Coues has given a very full biographical account of it in the article above cited.

**GEOGRAPHICAL DISTRIBUTION.**—The present species is well known as an inhabitant of the marshy lowlands of the South Atlantic States. The most northern locality from which I have seen specimens is Fort Macon, North Carolina, but it in all probability will be found to range northward to the lowlands of Southeastern Virginia. Audubon and Bachman speak of it as abundant in the swamps of Georgia, Alabama, Louisiana, and Texas, but Professor Baird has questioned the authenticity of some of these localities, and states that he had never "seen a specimen from the region west of Georgia." Professor Baird's specimens were all from South Carolina and Georgia; there are now in the collection additional specimens from Florida, and one from near Vera Cruz, Mexico. It hence seems probable that it may exist along the Mexican coast from Texas to Yucatan. Audubon and Bachman believed it would eventually be found in Mexico, as has proved to be the case. In the lowlands of the Lower Mississippi, it extends as far north as Southern Illinois, both Mr. Robert Ridgway and Mr. E. W. Nelson informing me that a Marsh Hare occurs along the Wabash River as far up as Mt. Carmel, Illinois.\*

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\* Mr. Ridgway, under date of April 17, 1876, kindly wrote me on this point as follows: "A 'Swamp Rabbit' or 'Water Rabbit' is common in Southern Illinois as far north as Mount Carmel, but whether it is *palustris* or *aquaticus* I do not know. It is of very common occurrence in the bottom lands, where it frequents bushy swamps and the borders of creeks." Mr. Nelson, under date of April 30, 1876, wrote me that, when visiting the same locality in the summer of 1875, he "was led to suspect its occurrence in abundance along the Wabash River as far up as Mount Carmel." He adds: "My informants told me that they found this animal only in damp situations, along the river or about the bayous, in places grown up with rushes or willows, and from the nature of their haunts were very difficult to procure. I afterward found that this species was common in the canebrakes near Cairo, although less abundant than *L. aquaticus*."

TABLE LV.—Measurements of *LEPUS PALUSTRIS*.

Catalogue-number of skin.	Locality.	Sex.	From tip of nose to—		Tail to end of—		Length of hind foot.	Height of ear.	Remarks.
			Occip.	Tail.	Verteb.	Hairs.			
1025	Society Hill, E. O .....	.....	2.43	14.30	.....	.....	3.33	2.50	From Baird.
1054	.....do .....	.....	2.80	15.00	.....	.....	3.77	2.39	.....do.
1056	.....do .....	.....	2.19	12.50	0.98	1.78	3.40	2.30	.....do.
1013	Saint Simon's Island, Ga. ....	.....	2.60	17.00	0.75	1.50	3.90	2.60	.....do.
1015	.....do .....	.....	3.50	16.00	0.65	1.45	3.50	.....	.....do.
1016	.....do .....	.....	3.38	18.00	.....	.....	3.35	2.48	.....do.
1019	.....do .....	.....	3.48	16.50	.....	.....	3.40	2.38	.....do.
1040	.....do .....	.....	3.45	17.00	.....	.....	3.50	.....	.....do.
1081	.....do .....	.....	3.65	17.00	.....	.....	3.40	2.97	.....do.
1211	Georgia .....	.....	.....	16.50	.....	.....	3.45	2.38	.....do.

TABLE LVI.—Measurements of skulls of *LEPUS PALUSTRIS*.

Catalogue-number of skull.	Locality.	Total length.	Greatest width.	Distance between orbits.	Nasal bones, length.	Nasal bones, width behind.	Nasal bones, width before.	Upper incisors from front to molars.	Upper incisors from front to hinder margin of palate.	Upper incisors, height.	Upper incisors, width between external edges.	Upper molars, length taken together.	Upper molars, distance between.	Lower jaw, length.	Lower jaw, height.
9067	Saint Simon's Island, Ga.	3.10	1.47	0.66	1.25	0.53	0.54	1.00	1.33	.....	.....	0.60	0.45	2.35	1.53
9453	.....do .....	3.13	1.46	0.75	1.27	0.53	0.54	0.94	1.30	0.35	0.86	0.65	0.53	2.35	1.55
9454	.....do .....	3.00	1.48	0.68	1.28	0.53	0.54	0.94	1.23	0.30	0.84	0.57	0.46	2.27	1.50
9455	.....do .....	3.06	1.48	0.73	1.20	0.56	0.56	0.95	1.38	0.34	0.87	0.60	0.46	2.40	1.52
9456	.....do .....	3.00	1.45	0.67	1.15	0.58	0.50	0.92	1.30	0.33	0.82	0.56	0.45	2.38	1.53
9457	.....do .....	3.20	1.52	0.73	1.29	0.58	0.52	1.00	1.35	0.35	0.90	0.62	0.47	2.50	1.50
9458	.....do .....	3.00	1.43	0.66	1.15	0.53	0.50	0.92	1.25	0.35	0.87	0.57	0.49	2.27	1.54
9459	.....do .....	3.05	1.45	0.67	1.20	0.53	0.52	1.00	1.32	0.32	0.85	0.56	0.45	2.32	1.50
9460	.....do .....	3.03	1.40	0.60	1.23	0.57	0.52	0.93	1.27	0.32	0.86	0.56	0.43	2.30	1.50
9461	.....do .....	3.06	1.47	0.66	1.17	0.55	0.50	0.93	1.26	0.32	0.87	0.62	0.45	2.32	1.52
9462	.....do .....	3.10	1.45	0.67	1.33	0.48	0.54	0.97	1.28	0.33	0.88	0.62	0.47	2.37	1.52
4300	Georgia .....	3.10	1.57	0.73	1.21	0.52	0.54	0.93	1.30	0.31	0.88	0.60	0.46	2.36	1.65
8065	Fort-Mason, N. O .....	3.10	1.45	0.70	1.22	0.53	0.60	0.97	1.35	0.28	0.82	0.57	0.44	2.42	1.53
	Maximum .....	3.20	1.57	0.75	1.33	0.56	0.60	1.00	1.35	0.35	0.90	0.65	0.53	2.42	1.65
	Minimum .....	3.00	1.40	0.66	1.15	0.48	0.50	0.92	1.23	0.26	0.84	0.57	0.42	2.20	1.50
	Average .....	3.07	1.51	0.71	1.24	0.54	0.52	0.97	1.29	0.32	0.82	0.60	0.45	2.32	1.54

TABLE LVII.—List of specimens of *LEPUS PALUSTRIS*.

Catalogue-number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
9417	1693			Fort Macon, N. C.	May —, 1880	Dr. E. Coues	Dr. E. Coues	Skin.
9418	1694			do	do	do	do	do
9419	1695			do	do	do	do	do
	9963	Q		do	do	do	do	Skull.
1955	9090			Society Hill, S. C.	Winter	M. A. Curtis & Sons	M. A. Curtis & Sons	Skin and skull.
	9099			do	do	do	do	Skull.
	9098			do	do	do	do	do
1850				do	do	do	do	do
1811	9057			Saint Simon's Isl., Ga.		J. Postell	J. Postell	Skin and skull.
1618	9451			do		Dr. S. G. Wilson	Dr. S. G. Wilson	do
	9903			do		do	do	Skull.
	9304			do		do	do	do
	9905			do		do	do	do
	9906			do		do	do	do
	9461			do		do	do	do
	9469			do		do	do	do
	9453			do		do	do	do
	9454			do		do	do	do
	9455			do		do	do	do
	9456			do		do	do	do
	9457			do		do	do	do
	9458			do		do	do	do
1801				do		do	do	Skin.
4018				do		do	do	do
1614	9459			do		do	do	Skin and skull.
	9460			do		do	do	Skull.
	6369			do		do	do	do
*1439				Hibernia, Fla.		Mus. Comp. Zoology	J. A. Allen	Skin.
*2143				South Carolina			L. Agassiz	do
6357				Mirador, Mexico		Dr. G. Sartorius	Dr. G. Sartorius	do

\* Specimens from the Museum of Comparative Zoology, Cambridge, Mass.

## LEPUS AQUATICUS Bachman.

## Water Hare.

*Lepus aquaticus* BACHMAN, Journ. Acad. Nat. Sci. Phila., vii, 1837, 319, pl. xxii, fig. 2; viii, 1839, 78.—WATERHOUSE, Nat. Hist. Mam., ii, 1848, 112.—AUD. & BACH., Quad. N. Am., i, 1849, 287, pl. xxxvii.—BAIRD, Mam. N. Am., 1857, 612, pl. lix, fig. 1 (skull).—ALLEN, Proc. Bost. Soc. Nat. Hist., xvii, 1875, 435.—LINCOLN, Ann. Nat. vi, 1878, 771 (distribution and habits).

*Hydrolagus aquaticus* GRAY, Ann. & Mag. Nat. Hist., 3d ser., xx, 1867, 291.

*Lepus douglasii* var. 1, GRAY, Charlesworth's Mag. Nat. Hist., i, 1837, 580.

† "*Lepus cuniculus* LIGHT," WATERHOUSE, Nat. Hist. Mam., ii, 1848, 132.

As large as *Lepus americanus*; in coloration, much like *L. sylvaticus*. Above, yellowish-brown, finely but conspicuously mixed with black; paler and with less black on the sides. Below, pure white, with the fore neck and breast dusky yellowish-brown. Tail conspicuously pure white below, dark

reddish-brown above, mixed with dusky. Ears exteriorly dark brown, penciled with black, white-edged on the anterior border, fulvous-edged on the posterior border. Nape-patch reddish-brown; orbital ring well marked, whitish, varying to yellowish-white. Anterior and external surfaces of the legs and feet chestnut-brown, of varying intensity in different individuals; inside of the same whitish, varying to pure white.

The color varies in different individuals, as is usual in all the species of the family, in respect to the amount of black on the dorsal surface, in respect to the intensity of the brownish ground-color, and in the strength of the reddish tint on the legs and feet. There is also about the usual range of individual variation in size. Large specimens range in length, exclusive of the tail, from 19.00 to 20.50 inches, thus nearly equaling the same measurement of the largest specimens of *Lepus americanus*, but it is said to rather exceed the latter species in weight. The feet are rather sparsely furred as compared with most of the other North American species, but are much more fully clothed than in *Lepus palustris*. The general pelage is rather harsh and stiff as compared with that of *L. sylvaticus* and other northern forms, but much less so than in *L. palustris*. Its coloration is nearer that of *L. sylvaticus* than of any other of its allies, but its large size, and especially the large size of the head, serves at once to distinguish it from that species. It is not only much larger than *L. palustris*, but differs conspicuously from it in coloration, especially in the whiteness of the lower parts. It agrees with *L. palustris*, however, in the general conformation of the skull, especially in respect to the postorbital processes being solidly ankylosed with the skull, and in the disproportionately larger size of the lower jaw.

In the collection are quite a number of specimens from the provinces of Vera Cruz and Yucatan in Southern Mexico. These differ from specimens from Mississippi and Louisiana in no very marked degree. The brown of the upper parts is in some specimens of a rather more fulvous tint, and the chestnut-brown of the legs and feet is rather paler; the anterior surface of the hind legs being generally very light, sometimes nearly white. In others, it is mixed with spots of pale rufous. There is also rather less black in the dorsal surface. One of the Louisiana specimens also shows white mixed with the rufous on the anterior surface of the hind legs, and one of the specimens from Mississippi is nearly as fulvous as the Orizaba ones.

A specimen labeled "Sierra Madre, Mex., John Xantus", with the

pelage very much worn and the colors faded, seems to unquestionably belong to this species.

GEOGRAPHICAL DISTRIBUTION.—The present species is said to be unknown in the Gulf States to the eastward or northward of Alabama. Audubon and Bachman state that it is "numerous in all the swamps of the western part of that State, is still more abundant in the State of Mississippi, and in the lower part of Louisiana", and that it was also obtained in Texas by Douglass and Mr. J. W. Audubon. Professor Baird considers doubtful its occurrence "in the southern part of Texas". Dr Lincecum, however, calls it "a widely-distributed species", and says "it abounds in the canebrakes of Alabama, Mississippi, Louisiana, Arkansas, and Texas", where it is found "on all the water-courses, even on the little branches", but "rarely on the uplands". The specimens in the present collection from Southeastern Mexico, as far south even as Merida, Yucatan, would seem to render probable its occurrence in the lowlands bordering the Gulf of Mexico from Alabama to Yucatan. It also occurs as far northward as Southern Illinois. Of this fact I am assured by Mr. E. W. Nelson, who writes me respecting it as follows: "*L. aquaticus* is abundant in the canebrakes near Cairo and Mound City, Illinois, and doubtless extends as far up the Ohio as the mouth of the Wabash, at least. . . . . It extends up the Mississippi as far as Cape Girardeau, to my knowledge, and probably still further in suitable situations. It is so common in the canebrakes near Mound City that a hunter informed me he had often, during the winter months, shot as many in a day as he could carry." Professor Baird also says, "Mr. Kennicott mentions a 'Swamp Rabbit' as occurring in the wet grounds of New Madrid, Missouri."

TABLE LVIII.—Measurements of *LEPUS AQUATICUS*.

Catalogue-number.	Locality.	From tip of nose to—		Tail to end of—		Length of hind foot.	Height of ear.	Remarks.
		Occip.	Tail.	Verteb.	Hairs.			
897	Mississippi.....	3.25	10.00	.....	.....	.....	3.10	From Baird.
891	do.....	.....	15.50	.....	.....	3.65	2.98	do.
9206	Prairie Mer Rouge, La.....	4.10	17.50	1.60	2.40	4.07	3.10	do.
9207	do.....	2.65	30.50	1.75	2.98	3.86	2.69	do.
9208	do.....	3.00	10.00	.....	.....	4.90	.....	do.
9209	do.....	3.90	19.00	2.90	2.81	3.75	2.68	do.
9210	do.....	.....	17.00	.....	.....	3.69	2.75	do.
921	Calcasieu, La.....	3.33	16.00	2.08	2.92	4.09	2.65	do.

TABLE LIX.—Measurements of skulls of *LEPUS AQUATICUS*.

Catalogue-number.	Original number.	Locality.	Total length.	Greatest width.	Distance between orbits.	Nasal bones, length.	Nasal bones, width behind.	Nasal bones, width before.	Upper incisors from front to hinder margin of palate.	Upper incisors, height.	Upper incisors, width between external edges.	Upper molars, length taken together.	Upper molars, distance between.	Lower jaw, height.
1928	291	Calcasieu, La. ....	3.45	1.57	0.82	1.46	0.65	0.66	1.10	1.53	0.36	0.30	0.50	1.65
3133	3310	Prairie Mer Rouge, La. ....	3.30	1.45	0.75	1.30	0.56	0.54	1.06	1.43	0.33	0.29	0.32	1.52
3778	.....	Mississippi .....	3.40	.....	0.70	1.45	0.66	0.60	1.06	1.45	0.40	0.30	0.52	1.67
3779	.....	.....do.....	3.46	1.65	0.82	1.43	0.67	0.64	1.07	1.50	0.37	0.35	0.67	1.70
11775	.....	.....do.....	3.40	1.57	0.82	1.50	0.67	0.62	1.12	1.50	0.36	0.39	0.50	1.63

TABLE LX.—List of specimens of *LEPUS AQUATICUS*.

Catalogue-number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
697	.....	.....	.....	Garlandville, Miss. ....	Apr. —, 1855	Mr. Robinson. ....	Mr. Robinson. ....	Skin.
.....	3778	.....	.....	Mississippi .....	.....	Col. B. L. C. Wallis. ....	Col. B. L. C. Wallis. ....	Skull.
.....	3779	.....	.....	do .....	.....	do .....	do .....	do.
.....	11775	.....	.....	do .....	.....	Colonel Canley. ....	Colonel Canley. ....	do.
2306	.....	.....	.....	Prairie Mer Rouge, La. ....	.....	James Fairie. ....	James Fairie. ....	Skin.
2307	.....	.....	.....	do .....	.....	do .....	do .....	do.
2308	.....	.....	.....	do .....	.....	do .....	do .....	do.
2309	.....	.....	.....	do .....	.....	do .....	do .....	do.
.....	1580	.....	.....	Calcasieu, La. ....	.....	G. Würdemann. ....	G. Würdemann. ....	Skull.
.....	3133	.....	.....	Prairie Mer Rouge, La. ....	.....	James Fairie. ....	James Fairie. ....	do.
1460	.....	.....	.....	Brazos River, Texas. ....	.....	Mus. Comp. Zool. ....	.....	Skin.
11433	.....	828	♂	Merida, Yucatan. ....	Mar. 6, 1865	J. S. Llarrequi. ....	Dr. A. Schott. ....	do.
11434	.....	827	.....	do .....	.....	do .....	do .....	do.
11437	.....	143	♀	do .....	Feb. 4, 1865	do .....	do .....	do.
11440	.....	829	♀	do .....	Feb. 7, 1865	do .....	do .....	do.
11441	.....	807	♀	do .....	Feb. 23, 1865	do .....	do .....	do.
11443	.....	809	♂	do .....	.....	do .....	do .....	do.
11444	.....	368	♂	do .....	.....	do .....	do .....	do.
7908	.....	.....	.....	Orizaba, Mex. ....	.....	Prof. F. Sumichrast. ....	Prof. F. Sumichrast. ....	do.
8118	.....	.....	.....	do .....	.....	M. Botteri. ....	M. Botteri. ....	do.
8563	.....	.....	.....	do .....	.....	do .....	do .....	do.
8563	.....	.....	.....	do .....	.....	do .....	do .....	do.
8584	.....	.....	.....	do .....	.....	do .....	do .....	do.
8585	.....	.....	.....	do .....	.....	do .....	do .....	do.
.....	.....	487	♂	Sierra Madre, Mex. ....	Apr. —, 1893	John Xantus. ....	John Xantus. ....	do.

*LEPUS CUNICULUS* Linnæus.

## EUROPEAN RABBIT.

In addition to the indigenous species of American *Leporidae*, a single introduced species—the Common Rabbit (*Lepus cuniculus*) of the Old

World—has to such an extent reverted to a feral condition in a few localities as to deserve a passing notice in the present connection. Mr. B. R. Gilpin states\* that the Rabbit exists in a wild state on "Sable Island, a desert island about ninety miles southeast of Nova Scotia." Here he says they have, in the space of fifty years, assumed "one common silver-gray tint, with white collars."

Count L. F. de Pourtales informs me that some years since he was told by Colonel Patterson, an old resident of Florida, of the existence of some Rabbits which lived in burrows on Rabbit Key near Key West, which in all probability were the *L. cuniculus*. Mr. P. H. Gosse states, on the authority of Mr. Richard Hill, that the Common Rabbit had reverted to a feral condition in certain parts of the island of Jamaica.† Darwin says later, also on the authority of Mr. Hill, that it never flourished there, owing to the unfavorable character of the climate, and that, owing to a great fire which occurred in the woods, they became extinct.‡

Darwin also states that the Rabbit, long since introduced into the Falkland Islands, has there also reverted to a feral condition. He adds, however, that they have never spread there extensively, although abundant over large parts of the East Falkland Island. Like the Horses, they are confined within certain limits, and had not, at the time of his visit, crossed the central chain of hills, nor would they have extended even so far as its base, had not, according to the Gauchos, small colonies been carried there. Most of them, he says, are of the common gray color, but a few are "hare-colored", and many are black, often with symmetrical white marks on their faces. As already noted, M. R. P. Lesson described the black variety as a distinct species, under the name *Lepus magellanicus*. M. Lesson was mistaken, however, in supposing it to also occur on the adjoining mainland. Darwin also states that within recent times the sealers have stocked some of the small outlying islets of the Falkland group with Rabbits.§

In a state of domestication, the Rabbit is found throughout a considerable part of both Americas, multiplying freely under very diverse climatic conditions, existing as far north as Nova Scotia and the Canadas and also within the tropics.

\* Trans. Nova Scotia Institute Nat. Sci., vol. iii, p. 126, (1872.)

† Gosse's Sojourn in Jamaica, 1841, p. 441.

‡ Animals and Plants under Domestication, vol. i, p. 141.

§ Respecting the occurrence of the Rabbit on the Falkland Islands, see Darwin's Journal of Researches, p. 193; Zoölogy of the Voyage of the Beagle, Mammalia, n. 92; Animals and Plants under Domestication, vol. i, p. 141.

## SPECIES WRONGLY ATTRIBUTED TO AMERICA.

In 1837, Dr. J. E. Gray\* described a *Lepus longicaudatus* from a specimen supposed to have been brought from "Magellan Land" by Capt. P. P. King. This specimen was redescribed under the same name by Dr. Bachman† in 1839, who says: "The specimen from which I have made the above description [of *L. longicaudatus*] is the original one from which Mr. Gray established the characters of this species. It was obtained by Douglass on his last visit to the southwestern coast of North America, and was sent to England after his melancholy death. The precise locality is not known, but is supposed to be in the northwestern part of Texas." Wagner,‡ in 1844, also gave a description of a "*Lepus longicaudatus* Bachman", compiled from the preceding authors, and the name also figures later in the works of several compilers. Waterhouse,|| in 1848, speaks of it as a purely nominal species, and says it was based on "a specimen in the museum of the Zoölogical Society, from which the label had become detached and lost", and which "was surmised to be a native of this part [California] of America, as it was likewise of the southernmost part of South America". He adds that the specimen "proves to be a South African animal, being, without doubt, the *L. saxatilis*". Gray§ later also cites his *L. longicaudatus* among his synonyms of *L. saxatilis*, but at the same time retains it as a doubtful species from "Magellan's Straits"!

A species was described by Lesson,¶ in 1826, as *Lepus magellanicus*, from specimens from the Falkland Islands, which proved, as stated above, to be merely the common *Lepus cuniculus* in a feral state.

## NOTE ON THE NAMES "RABBIT" AND "HARE."

"What is a 'Rabbit' as distinguished from a 'Hare'?" or conversely, is a question one often hears in relation to our American species of *Leporidae*, and one deserving of a moment's attention, since many suppose these names to have a definite application. Much, indeed, was originally the case, *Hare* being a generic name and *Rabbit* the distinctive name of a particular species of *Hare*. Thus, in England, *Rabbit* is the distinctive English name of the

\* Charlesworth's Mag. Nat. Hist., vol. i, p. 586, 1837.

† Journ. Acad. Nat. Sci. Phila., vol. viii, p. 84, 1839.

‡ Schreber's Säugeth., Suppl., vol. iv, p. 116, 1844.

§ Nat. Hist. Mam., vol. ii, p. 132, 1848.

¶ Ann. and Mag. Nat. Hist., 3d ser., vol. xx, p. 223, 1867.

¶ Bull. des Sci. Nat., viii, 96.



*Lepus cuniculus*, and, as Waterhouse observes, is from the Dutch *Robbeken*. The species was also often anciently called *Cony* in England, and is generally known by some analogous word in other European countries, the Italians calling it *Coniglio*; the Spaniards, *Conejo*; the Welch, *Cwningen*; the Danes and Swedes, *Kaning*, etc., all traceable, as etymologists tell us, to the Latin word *cuniculus*. *Rabbit* is as distinctively a specific name as is its Latin equivalent *cuniculus* in scientific nomenclature, or as *Robin* is in America for the designation of a particular kind of Thrush. Hence *Rabbit* is properly applicable to the *Lepus cuniculus*, and to no other species of the Hare family.

*Hare*, on the contrary, is as much a generic or family name as is either Mouse, Squirrel, Bat, Hawk, or Thrush, and may be properly applied to any species of the family. In England, when used without a qualifying word, it refers to the "Common Hare", or *Lepus europæus* (= *timidus* of authors generally), and its unmodified equivalent is similarly used in other European countries. The analogues of *Hare*, as *Has* of the Dutch, *Hase* of the Germans, *Hare* of the Danes and Swedes, etc., are also similarly used for the designation of any species of the Hare family, to which are added qualifying words to indicate particular species, as in English we speak of the *Varying Hare*, the *Polar Hare*, the *Mediterranean* or *Sardinian Hare*, *Prairie Hare*, etc.\*

It hence follows that, strictly speaking, the term *Rabbit* is not applicable to any species of American Hare; the term *Hare*, with some qualifying word, as *Marsh Hare*, *Californian Hare*, etc., being technically the only admissible appellative for our indigenous species. Practically, however, the terms *Hare* and *Rabbit* in this country have become interchangeable, either designation being used for any of the species according to individual predilection, though generally, perhaps, there is a tendency to restrict the name *Hare* to the larger species. Hence the terms *Rabbit* and *Hare* have, in the United States at least, ceased to become distinctive of any specific diversity or peculiarities of habit or structure. The *Rabbit* proper, or the *Lepus cuniculus*, differs from most other species of the family in its habit of burrowing, and from most of the other Old World species in the shortness of its hind legs. Many of our American species, however, resort more or less habitually to the deserted burrows of other animals for protection, either from their enemies

\* Waterhouse, in his excellent work on the *Rodentia*, scrupulously applies the term *Hare* to every species of the Hare family, except *L. cuniculus*, which he calls 'the Rabbit or Cony', the latter name being the one anciently in general use for this species.

or from the severity of the weather, if they do not actually excavate them themselves. This is a well-known habit, in many localities, of our common so-called Gray Rabbit (*L. sylvaticus*), and also of the *Lepus campestris*, or so-called Prairie Hare. At localities where *L. americanus* and *L. sylvaticus* occur together, the former is often designated as the *Hare* and the latter as the *Rabbit*. Perhaps, however, the one is oftener called *White Rabbit* and the other *Gray Rabbit*. Gray Rabbit, perhaps from long familiarity with the same, seems to sound more euphonious than Gray Hare; Marsh Hare than Marsh Rabbit; and Jack Rabbit or Jackass Rabbit than Jack Hare or Jackass Hare; and, however philologically or technically wrong it may be to apply the term Rabbit to any of our wild species, the custom of so doing among the generality of our people is doubtless as ineradicably fixed as is that of calling the American Bison a Buffalo.

EPIDEMICS AMONG THE NORTH AMERICAN SPECIES OF HARES.

Nothing is better known to attentive observers of our Mammals than the fact that certain species, especially of the Rodentia, are for a period of years often exceedingly abundant, these periods being followed by succeeding years of scarcity. This is especially observable among the Field Mice (particularly in the case of *Arvicola riparius*), the Squirrels, and the Hares. Their decrease results usually from some not very obvious cause, though sometimes supposed to be connected with a series of unusually severe winters. That this is not the sole cause of their decrease I have been for a long time convinced, but that it is due more to some prevalent epidemic. The evidence of this is not generally easily obtainable, but proof of it in other cases is quite abundant. In the case of our little Wood Hare (*Lepus sylvaticus*), I have repeatedly met with their dead bodies in the woods and thickets, bearing no mark of a violent death, and noted the scarcity of these animals during the years immediately following. I have also observed the same thing in respect to our common Meadow Mouse (*Arvicola riparius*). I find also recorded in my notes a remarkable decrease, some years since, of the large Long-eared Hares (*L. callotis* var. *texianus* and *L. campestris*) in the Great Salt Lake Valley. This decrease was also accompanied by the finding of great numbers of the animals dead on the Sage-brush plains about the lake, showing no signs of a violent death (of which fact I was abundantly assured by the residents of the region in question), leading to the conclusion that their death

was due to an epidemic. So abundant had these species been for several years prior to 1869 and 1870 that some of the Mormon residents were accustomed to shoot them merely to feed their swine; while so scarce had they become in 1871 that comparatively few of either species were to be found, and it was with difficulty that I could obtain any specimens.

Richardson, in speaking of the Northern Hare (*Lepus americanus*), states that "at some periods a sort of epidemic has destroyed vast numbers of Hares in particular districts, and they have not recruited again until after a lapse of several years, during which time the Lynxes were also scarce."\* Dr. J. G. Cooper has also recorded a similar fact respecting the Hares of Columbia Plains. He says: "During our journey east of the Cascade Mountains we saw scarcely any Hares, and the Indians told us that some fatal disease had killed nearly all of them."† Mr. G. Gibbs, in speaking of the same region, says, under the head of *Lepus campestris*: "In 1853, we were informed by the Yakima Indians living north of the Columbia, that a very fatal disease had recently prevailed among these animals, which had cut them almost all off."‡ Dr. Cooper, some years later, again refers to the same subject as follows: "Their numbers [referring to *L. townsendi* = *L. campestris*] seem never to have increased much north of the Columbia and Snake Rivers since the epidemic (small-pox?) destroyed them several years since, but south of those rivers they became common." He adds, however: "It is a question whether an epidemic really made them scarce northward, or whether the prevalence of uncommonly deep snow did not enable the Indians to kill more of them, as with Deer and Antelopes."§ According to the testimony of the Indians themselves, however, they were destroyed by an epidemic.

Similar epidemics are also well known to affect the Deer and Pronghorns. As I have stated elsewhere,|| a fatal epidemic raged among the Pronghorns (*Antilocapra americana*) during the summer of 1873 over nearly the whole area between the Yellowstone and Missouri Rivers, destroying apparently three-fourths to nine-tenths of them, over which extensive region their decaying carcasses were abundant during September of that year. At this time, very few were seen living, where a few months before numbers were almost constantly within view.

\* Fauna Bor.-Amer., vol. i, p. 218.

† P. R. R. Reports, vol. xii, pt. ii, p. 87.

‡ P. R. R. Reports, vol. xii, pt. ii, p. 131.

§ American Naturalist, vol. ii, p. 536.

|| Proc. Bost. Soc. Nat. Hist., vol. xvii, p. 40.

## SUPPLEMENTARY NOTE TO THE MONOGRAPH OF THE LEPORIDÆ.

### EXTINCT AMERICAN HARES.\*

Some half dozen species of extinct Hares have been described, mainly from the Miocene deposits of Dakota and Colorado. As they are at present known merely from a few jaw-fragments and detached teeth, little more can be said of them than that they were animals of rather small size, and belonged to the family of the Hares. Their true character and relationships can, of course, be understood only by the study of much additional material.

### GENUS PALÆOLAGUS Leidy.

*Palæolagus* LEIDY, Proc. Acad. Nat. Sci. Phila., 1856, 89.—COPE, Ann. Rep. U. S. Geol. Surv. Terr. for 1873 (1874), 477.

*Tricium* COPE, Paleontol. Bull. No. 16, 1873, 4.

Dr. Leidy has described a single species from the Miocene deposits of Dakota, and Professor Cope has made known allied forms from deposits of the same age in Colorado. Our knowledge of these forms rests on fragments of the jaws, and is hence very imperfect. The dental formula is the same as in *Lepus*, but the molar teeth differ somewhat in constitution. A single species of this genus has been described by Dr. Leidy, and three others by Professor Cope.

### PALÆOLAGUS HAYDENI Leidy.

*Palæolagus haydeni* LEIDY, Proc. Acad. Nat. Sci. Phila., 1856, 89; 1857, 89; Journ. Acad. Nat. Sci. Phila., 2d ser., v, 1869, 331, 404, pl. xxvi, figs. 14-20; U. S. Geol. Survey of Wyoming, 1871, 363.—COPE, Ann. Rep. U. S. Geol. Survey of Terr. for 1873 (1874), 478.

*Tricium acuminatus* COPE, Paleontol. Bull. No. 16, 1873, 4.

"*Tricium anax* COPE" (see Ann. Rep. U. S. Geol. Survey of Terr. for 1873 (1874), 478).

This species is known only from a considerable number of fragments of upper and lower jaws with teeth, collected by Dr. Hayden from the Miocene

\*Having decided, since the foregoing pages were put in type, to include in these monographs notices of the extinct species, as well as of the existing ones, this supplementary note is added to the Monograph of the *Leporidae*.

deposits of Dakota, and by Professor Cope from those of Colorado. "The fossils indicate," says Dr. Leidy, "a species rather less in size than the Gray Rabbit (*Lepus sylvaticus*). They vary among themselves in size and robustness; but, independently of what may be considered as individual peculiarities, the differences appear to depend mainly on difference of age. In regard to the form of the jaw-fragments, consisting merely of the portions containing molar teeth, they agree nearly with the corresponding portions in the Rabbit, except that they appear proportionately more robust. In a corresponding position of the jaw there does not exist in the fossils the reticular foramina observed in the vicinity of the mental foramen in the Rabbit." While having the same number of teeth as the existing Hares, they were at first supposed to differ somewhat in the constitution of the first lower molar, which Dr. Leidy described as composed of merely a double column instead of a triple column. Professor Cope,\* however, states that, having collected a great number of the remains of this genus, he is "able to show that it is only in the immature state of the first molar that it exhibits a double column, and that in the fully adult animal it consists of a single column with a groove on its external face. The dentition undergoes other still more important changes with progressing age, so as to present the appearance of difference of species at different periods." The roots of the lower incisors also penetrate considerably more posteriorly than in *Lepus*. Dr. Leidy describes in detail some ten or more fragments, representing both upper and lower jaws, and figures six specimens of varying ages, from those containing a part of the temporary molars to old specimens in which the teeth are very much worn. Professor Cope states that he has examined several hundred specimens of this species collected in Colorado, and gives a detailed account of the changes in dental characters resulting from age. The earliest dentition known to him, he says, is the presence of two deciduous molars, the first and second in position, which appear before any of the permanent series. "Each of these has two roots, and the crown is composed of three lobes. In the first, the first lobe is a simple cusp; the two following are divided into two cusps each; the second is similar, excepting that the simple cusp is at the posterior end of the tooth. The grooves separating the lobes descend into the alveolus on the outer side, but stop above it on the inner. . . . In the next stage, the third permanent molar is projected, and has, like the second deciduous, a

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\* Ann. Rep. U. S. Geol. Surv. Terr. for 1873 (1874), pp. 477, 478.

posterior simple column, whose section forms an odd cusp or lobe behind. The fourth true molar then follows, also with an odd fifth lobe behind. This lobed form of the molars is so different from that of the adult as to have led me to describe it as indicating peculiar species under the name of *Tricium avunculus* and *T. annæ*.

"In the next stage, the fifth small molar appears in view, and the second permanent molar lifts its milk-predecessor out of the way. In a very short time, the posterior, or odd, columns entirely disappear, sinking into the shaft, and the permanent molars assume the form characteristic of the species. The last stage prior to maturity sees the first milk-molar shed, and the younger portion of the first permanent molar protruded. There is the merest trace of a posterior lobe at this time, and that speedily disappears. The anterior lobe is subconical, and is entirely surrounded with enamel. By attrition, the two lobes are speedily joined by an isthmus, and for a time the tooth presents an 8-shaped section, which was supposed to be characteristic of the genus. Further protrusion brings to the surface the bottom of the groove of the inner side of the shaft, so that its section remains in adult age something like a B."

#### PALÆOLAGUS AGAPETILLUS Cope.

*Palæolagus agapetillus* Cope, Palæont. Bull., No. 15, 1873, 1; Ann. Rep. U. S. Geol. Surv. Terr. for 1873 (1874), 478.

Smaller than *P. haydeni*, but more robust, with larger incisor teeth. Molars all composed of two columns. Founded on a mandibular ramus, with the first and last permanent molars just protruding. From the Miocene deposits of Colorado.

#### PALÆOLAGUS TURGIDUS Cope.

*Palæolagus turgidus* Cope, Palæont. Bull., No. 16, 1873, 4; Ann. Rep. U. S. Geol. Surv. Terr. for 1873 (1874), 479.

*Tricium panienae* Cope, Palæont. Bull., No. 16, 1873, 5.

Larger than *P. haydeni*, but otherwise not much different. From the Miocene deposits of Colorado.

#### PALÆOLAGUS TRIPLEX Cope.

*Palæolagus triplex* Cope, Palæont. Bull., No. 16, 1873, 4; Ann. Rep. U. S. Geol. Surv. Terr. for 1873 (1874), 479.

Similar in size to *P. haydeni*, from which, however, Professor Cope regards it as distinct. From the same Miocene deposits of Colorado. Known only from an imperfect mandibular ramus.

## GENUS PANOLAX Cope.

*Panolax* Cope, Proc. Acad. Nat. Sci. Phila., 1874, 151.

"Molars prismatic, transverse, except the first and last, each divided by a plate of enamel extending transversely from the inner side. Anterior molar longitudinal; posterior molar composed of two columns.

"This genus is represented by numerous teeth and portions of the cranium. It evidently belonged to the *Leporidae*, and is allied both to *Lepus* and *Palæolagus*. As the teeth are mostly separate, it is not easy to determine which is the posterior and which the anterior molar. Judging by the analogy of the known species, the determination as here made is correct. Should the relations be reversed, the species will be referred to *Palæolagus*."—(Cope, l. c.)

From the nature of the materials, the character of this genus cannot well be determined. Its admission here is of course provisional only.

## PANOLAX SANCTÆ-FIDEI Cope.

*Panolax sanctæ-fidei* Cope, Proc. Acad. Nat. Sci. Phila., 1874, 151.

This species is known only from several detached molar teeth, found in the Santa Fé marls. These marls have been regarded by Dr. Hayden as of late Tertiary age, and are found, according to Professor Cope, to contain the remains of numerous Pliocene genera, which show the fauna to be a part of that described by Dr. Leidy and Professor Cope as occurring in the Pliocene deposits of Colorado and Dakota.

In this species, the (supposed) first molar is described as having the triturating surface twice as long as broad, with an entering loop of enamel on the inner side; the last molar as being as wide antero-posteriorly as transversely, the shaft curved backward, the posterior column subcylindric, half the diameter of the anterior. This species Professor Cope supposes to have been of about the size of the Northern Hare (*Lepus americanus*), and hence considerably larger than *Palæolagus haydeni*, which is described by Dr. Leidy as being somewhat smaller than *Lepus sylvaticus*.

## GENUS PRAOTHERIUM Cope.

*Praotherium* Cope, Proc. Amer. Phil. Soc., xii, 1871, 93.

"Molars similar to those of *Lepus*, rootless, with oval crowns transverse to the axis of the series, all simple; masticatory surface not divided by median

ridge; enamel-boundary emarginate on the inner side. Number of molars in maxillary bone? four."—(Cope.)

This genus, according to Professor Cope, differs from *Lepus* and *Lagomys* in the absence of an enamel band dividing the triturating surface of each molar, though a trace of the dividing lamina is sometimes visible, but does not appear to ever form a transverse median crest. The normal number of teeth is uncertain, but supposed to be only four on each side of the upper jaw. Only one species has thus far been described, from remains found in the Port Kennedy bone-cave, Chester County, Pennsylvania, associated with those of a great variety of extinct species, mingled with a few of species still existing. The genus is known from the single species—

#### PRAOTHERIUM PALATINUM Cope.

*Praotherium palatinum* COPE, Proc. Amer. Phil. Soc., xii, 1871, 94, fig. 90.

This species was described by Professor Cope from the palatal portion of a skull, containing four molar teeth on each side in position, found in the Port Kennedy bone-cave. It differs, says Professor Cope, from the American species of *Lepus* in its small size, and in having the molars deeply grooved longitudinally on the inner instead of on the outer side. "In worn teeth, this groove is continued into the grinding surface of the crown, without interruption from the inclosing enamel. The form of this surface is then an oval, notched on the inner side, and rounded or slightly truncated on the outer. The palatine face is but partially preserved, and is considerably wider in proportion to the diameter of the teeth than in *Lepus sylvaticus*." In *Lepus callotis*, however, there is a deep longitudinal groove on the outer side of the tooth, and none on the inner; while, in *L. californicus*, there is quite a distinct groove on both sides. The prominence, or even presence, of the median transverse ridge varies with age in the living species, as Dr. Leidy has shown it to do in specimens of *Paleolagus haydeni*.

#### FOSSIL REMAINS OF EXISTING SPECIES.

In addition to the above described extinct species of Hares, the remains of several of the existing species have been met with in different bone-caves and elsewhere, sometimes associated with the remains of a variety of other extinct species of Mammalia. Dr. Leidy has recorded the occurrence of the fossil remains of *Lepus sylvaticus* in the crevices of the lead-bearing rocks of



Illinois, and in the Post-pliocene deposits of Ashley River near Charleston, South Carolina, and Professor Cope, from the Port Kennedy and other bone-caves in Pennsylvania and Virginia. The fossil remains of *Lepus brasiliensis* have also been found in the bone-caves of Brazil. It seems probable that ultimately will be found the remains of other species of American *Leporidae* in localities favorable for their preservation, as has been the case with the European species.

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MONOGRAPHS  
OF  
NORTH AMERICAN RODENTIA.

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No. III.—HYSTRICIDÆ.

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By J. A. ALLEN.

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## LETTER OF TRANSMITTAL.

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MUSEUM OF COMPARATIVE ZOOLOGY,

Cambridge, Mass., October 6, 1876.

SIR: I herewith transmit for publication my report on the North American *Hystricida*. This family is represented in that portion of North America north of Mexico by the single genus *Erethizon*.

For the use of the material on which this report is based, I am about equally indebted to the kindness of the officers of the Museum of Comparative Zoölogy and of the National Museum.

I am, sir, very respectfully, yours,

J. A. ALLEN.

Dr. F. V. HAYDEN,

*United States Geologist, etc., etc., Washington, D. C.*



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## FAMILY HYSTRICIDÆ.

By several recent systematic writers, the New World Porcupines have been widely separated from their Old World relatives; these authors placing them in different families. The two forms that differ most widely in cranial characters are *Erethizon* and *Hystrix*, especially in respect to the degree of inflation of the skull; but the other forms, in a measure, bridge over the wide gap existing between these two types in respect to this feature. The American Porcupines form a group collectively separable as a subfamily, by quite tangible characters, from the Porcupines of the Old World. While the former are arboreal, the latter are terrestrial, and the two types present modifications of structure adapting them to these widely different modes of life. There is, however, running through the whole, a strong degree of resemblance. The *Synetherina*\*, or the American Porcupines, differ from the Old World Porcupines in the form of the skull: in having the clavicles perfect; in the tail being generally (not, however, in *Erethizon*) more or less prehensile; in the molar teeth being fully rooted, and placed in more or less converging series; in not having five toes to all the feet (generally only four both before and behind); in the soles being tuberculated instead of smooth; in the upper lip being undivided by a vertical groove; in the form of the lachrymal bone; and in various other more or less important osteological characters.

The subfamily *Synetherina* is most numerous represented in South America, where occur three of its four genera, namely, *Chatomys*, *Synetheres*, and *Sphingurus*;† the fourth, *Erethizon*, being its only representative in North America north of Mexico. While these genera have many features in common, and constitute a very natural and well circumscribed group, *Erethizon* differs from the others in having five instead of four toes on the

\* *Synetherina* Gervais, Zool. et Paléont. franç., 1848-59, p. 18; *Sphingurina* Alston, Proc. Zool. Soc. Lond., 1876, 93; = *Cercolabina* of the family *Spalacopodidae* of Lilljeborg (Systematisk Öfversigt af de Guagande Däggdjuren, Gllres, 1866, p. 51) and of Gill (Arrang. Families of Mammals, p. 22).

† *Synetheres* and *Sphingurus* F. Cuvier, 1829, = *Cercolabes* Brandt, 1855.



hind feet, and in having a short, spiny, non-prehensile tail. The South American genus *Chatomys* differs from all of the others in the conformation of the skull; the malar bone is developed to a remarkable degree, more than in any other Rodent, excepting *Cælogenys*, the postorbital process of which nearly joins that of the frontal, so as to almost wholly separate the orbital and temporal fossæ. The portion of the palate between the molar teeth is also longer and narrower, and the temporal ridges are more highly developed, while the molars themselves present important differences. The tail is lengthened and rat-like, scantily clothed with hair, and scaly, though to some degree prehensile. The genera *Synetheres* and *Sphingurus* differ somewhat from *Erethizon* in their cranial and dental characters, and have the tail strongly prehensile, while the feet (as also in *Chatomys*) are all four-toed. *Synetheres* differs from *Sphingurus* in the broad, highly arched form of the frontal region of the skull, and in the greater development of the spines. *Chatomys* has but a single species (*C. subspinosus*), which is confined to the northern and central portions of Brazil. *Sphingurus* and *Synetheres* have each several commonly recognized species, which are distributed throughout the greater part of South and Central America, from Paraguay to Southeastern Mexico and the West Indies; none, however, occur west of the Andes. All the species are of rather small size in comparison with the representatives of *Erethizon*; the body rarely exceeding eighteen inches in length.

Considerable variation in the form of the frontal region of the skull occurs among both the *Hystrixinæ* and the *Synetherinæ*. In this respect, *Synetheres* approaches *Hystrix*, while the Old World genus *Atherura*, with its flattened skull, more resembles *Erethizon*. Even different species of *Hystrix* vary considerably in respect to the inflation and convexity of this portion of the cranium, showing that this is a feature of no very great taxonomic importance, though giving rise to striking differences in respect to the dorsal contour of the skull.

### GENUS ERETHIZON F. Cuv.

#### North American Porcupines.

*Hystrix*, in part, of earlier writers.

*Erethizon* F. CUVIER, Mém. du Mus., ix, 1822, 426, 432.

*Echinoprocta* GRAY, Proc. Zool. Soc. Lond., 1865, 321.

Toes four in front and five behind, all armed with strong, curved claws. Tail short, thick, depressed, non-prehensile, covered above at the base with

stiff hairs and spines, and on the sides, at the apex, and beneath with thick rigid bristles. Size large. Limbs short and strong.

As already stated, *Erethizon* differs from the other American Porcupines in possessing five toes to the hind feet, all armed with strong claws, and in its short, thick, non-prehensile tail. It also differs in its more approximated nostrils and in its large size. From the Old World Porcupines, with which it was formerly for a long time generically associated, in common with all the New World species, it presents many important points of difference. A comparison of the skull of *Erethizon* with that of *Hystrix* shows that the differences are far greater than the resemblances. When seen from above, the skull of *Erethizon* bears, in its general form, a striking similarity to that of *Arctomys*, the dorsal outline being nearly straight and the frontal region depressed and flat; the nasals are of about the same relative size and shape, and the zygomatic arch is similarly widely expanded laterally. *Erethizon*, however, lacks the greatly developed postorbital process of the frontal bones seen in *Arctomys*, and of course differs greatly in general details of structure. *Hystrix*, on the other hand, is exceptional among Rodents for the great development of the nasal and frontal elements of the skull, consequent upon the enormous size of the nasal and frontal sinuses. The frontals are hence twice the size of the parietals instead of being much smaller as in *Erethizon*, while the nasals are still more remarkably developed, they rapidly widening posteriorly and extending as far back as the middle of the zygomatic arch. This results in an interorbital breadth almost unparalleled among ordinary Rodents, equaling one-half of the total length of the skull instead of less than one-third, as in *Erethizon*, and gives to the skull a high, greatly swollen, convex, dorsal outline instead of the straight, flat one seen in *Erethizon*.\* The zygomatic process of the maxillary is greatly expanded and thickened, forming an immense oblique pier, about one-half as broad as long, for the attachment of the zygomatic arch, instead of being a rather slender, thin process, as in *Erethizon*, while the slender horizontal process of the same bone, which bounds the lower part of the anteorbital fossa, appears like a second small zygomatic arch. There hence results a structure as different from that of *Erethizon*, as can well be imagined. The orbital fossa is small, and the temporal many times smaller than in *Erethizon*, in which both are very large. The

\* In respect to the inflation of the skull, *Syntherisma* is about intermediate between *Hystrix* and *Erethizon*, the muzzle being wide, and the frontal region abruptly and greatly swollen. The molar series are also less convergent than in *Erethizon*.

palate in *Hystrix* is broad and flat, and of uniform breadth; in *Erethizon* it is narrowed anteriorly, and rises abruptly in front of the molars, and between the molar series presents a prominent, central, ragged keel. Without going into a further comparison, it may suffice to state that the structure of the skull in the two forms differs markedly in nearly every detail.

To the old Linnean genus *Hystrix* were for many years referred all the known Porcupines from both the Old and the New World. The group was first dismembered by M. F. Cuvier in 1822, who divided the Old World species into two groups, *Hystrix* and *Acanthion*,\* and the New World species into three, *Erethizon*, *Syntheres*, and *Sphingurus* ("Sphiggurus"). Brandt, in 1835, called special attention to the cranial differences characterizing the Old World and New World species, and adopted Cuvier's genus *Erethizon* for the North American species, but united the two South American genera of Cuvier into the single genus *Cercolabes*, which groups have since been commonly retained, with the limitations and names given by Brandt. *Cercolabes*, however, seems divisible into two generic groups, for which Cuvier's prior names should be retained.† *Chatomys* was established by Gray in 1843 for the *Hystrix subspinosus* of earlier authors.

The genus *Erethizon* is confined to the middle and northerly portions of the North American continent, and is represented by a single species, divisible into two easily distinguished geographical varieties or subspecies.

#### ERETHIZON DORSATUS (Linn.) F. Cuvier.

##### Var. DORSATUS.

##### Canada Porcupine.

- Hystrix dorsata* LINN., Syst. Nat., ed. x, i, 1758, 57; ed. xii, i, 1766, 76.—FORSTER, Phil. Trans., lxi, 1772, 374.—ERXLEBEN, Syst. Reg. Anim., 1777, 345.—GMELIN, Syst. Nat., i, 1784, 119.—SCHREBER, Säuget., iv, 1792, 605, pl. clxix.—SHAW, Gen. Zool. Mam., ii, 1801, 13, pl. xxv.—KÜHL, Beiträge zur Zoologie, 1820, 70.—DERMAEST, Mam., 1822, 345.—J. SABINE, Franklin's Journey to the Polar Sea, 1823, 664.—COZZENS, Ann. N. Y. Lyc. Nat. Hist., i, 1823, 191.—HARLAN, Fauna Amer., 1825, 190.—GODMAN, Amer. Nat. Hist., ii, 1826, 50.—GRIFFITH's Cuvier iii, 1827, 206; v, 1827, 263.—FISCHER, Synop. Mam., 1829, 368.—EMMONS, Quid. Mass., 1840, 71.—THOMPSON, Hist. Vermont, 1842, 47.—AUDUBON and BACHMAN, i, 1843, 277, pl. xxvi.
- Erethizon dorsatus* F. CUVIER, Mém. du Mus., ix, 423, pl. xx, figs. 1, 2, 8 (skull and molar).—BRANDT, Mém. Acad. St. Pétersbourg, 1835, 327.—WATERHOUSE, Nat. Hist. Mam., ii, 1848, 438.—GIEBEL, Säuget. 1855, 478.—WAGNER, Suppl. Schreber's Säuget., iv, 1844, 37 (in part).—BAIRD, Mam. N. Amer., 1858 568.—ALLEN, Bull. Mus. Comp. Zool., i, 1869, 235.

\* *Acanthion*, although applied to species with the frontal region of the skull only moderately swollen, has not been considered by most later writers as generically separable from *Hystrix*, the second of the two genera of *Hystriinae* commonly recognized being *Atherura*, first characterized seven years later by M. G. Cuvier.

† Alston (Proc. Zool. Soc. Lond., 1876, 94) considers *Syntheres* and *Sphingurus* as being not generically separable; he adopts *Sphingurus* as the tenable name of the group, and hence changes the name of the subfamily from *Cercolabinae* to *Sphingurinae*, although *Syntheres* has the precedence in Cuvier's memoir. Gervais, as early as 1852, used the name *Syntherina* as a subfamily name for the New World Porcupines, which name hence has many years' priority over *Sphingurinae*.

- Hystrix pilosus americanus* CATESBY, Nat. Hist. Carolina, i, 1731, xxx.  
*Hystrix pilosus* RICHARDSON, Faun. Bor.-Amer., i, 1829, 214.  
*Hystrix hudsonis* BRISSON, Règn. Anim. Quad., 1756, 128.  
*Hystrix hudsonis* DEKAY, New York Zool., i, 1842, 27, pl. xxv, fig. 1 (animal); pl. viii, figs. 2, a, b, c (skull).  
*Le Porc-épic de la Baye de Hudson*, BRISSON, Règn. Anim. Quad., 1756, 128.  
*L'Ursion* BUFFON, Hist. Nat., xii, 1764, 426, pl. lv.  
*Canada Porcupine* PENNANT, "Syn., 1771, 266; Hist. Quad., 1781, No. 257"; Arctic Zool., i, 1784, 169.—  
 GILPIN, Proc. & Trans. Nova Scotia Inst. Nat. Sci., ii, 1870, 89.  
*Bear Porcupine*, HARLAN, Faun. Amer., 1825, 190.

## VAR. EPIXANTHUS.

## Western Porcupine.

- Erethizon epixanthus* BRANDT, Mém. Acad. St. Pétersb., 1835, pl. i (animal), ix, figs. 1-4 (skull).—SCHINZ, Synop. Mam., ii, 1845, 266.—WATERHOUSE, Nat. Hist. Mam., ii, 1848, 442.—NEWBERRY, Pacif. R. R. Expl. & Surv., vi, iv, 1857, 62 (California and Oregon).—BAIRD, Mam. N. Am., 1858, 569.—KENNERLY, Pacif. R. R. Expl. & Surv., x, vi, 1859, 16 (Little Colorado River).—HAYDEN, Trans. Amer. Phil. Soc., xii, 1862, 149 (Upper Missouri).—COUES, Amer. Nat., i, 1867, 392; Proc. Acad. Nat. Sci. Phila., 1869, 135 (Arizona).—BROWN, Rep. Brit. Ass., 1869 (1870), 220.—STEVENSON, 2d Ann. Rep. U. S. Geol. Surv. Terr., 1871, 462.—MERRIAM, Sixth Ann. Rep. U. S. Geol. Surv. Terr., 1873, 666.—COUES & YARNOW, Wheeler's Expl. & Surv. west of the 100th Merid., v, Zool., 1875, 174.  
*Erethizon dorsatus* var. *epixanthus* ALLEN, Bull. Essex Inst., vi, 1874, 52, 57, 61, 66; Proc. Bost. Soc. Nat. Hist., xvii, 1874, 43.  
*Hystrix pilosus* PEALE, Mamm. U. S. Ex. Ex., 1848, 46 (Pacific coast).—WOODHOUSE, Sitgreave's Exped. down the Zúñi and Colorado Rivers, 1853, 54 (New Mexico).  
*Erethizon* [sp. ?] MAXIMILIAN, Wieg. Arch., 1862, i, 132.  
*Erethizon* (*Echinoprocta*) *rufescens* GRAY, Proc. Zool. Soc. Lond., 1866, 321.

## VAR. DORSATUS.

## Canada Porcupine.

General color brownish-black, varied above with yellowish-white. Body above densely clothed with long, soft, rather woolly hair, intermixed with straight, coarse hairs and bristles. The latter are four to six inches long, and are usually tipped with yellowish-white, the light tip varying in extent from one-fourth to seven-eighths of the length of the hair; sometimes it is obsolete, and again extends to the base, but involves usually only the exposed portion. Beneath this, and generally wholly concealed by the pelage proper, the dorsal surface is thickly set with erectable, barbed quills, or spines, varying in length from one to four inches. They are usually white basally and tipped with black, the black portion varying in extent from one-tenth to one-third the length of the quill; a few, however, are entirely white, and others occur entirely black. They vary greatly in size on different parts of the body; beginning on the nose as short, stiffened, pointed hairs, they pass into short spines between the eyes, and increase in length and thickness on the back of the head; thence continuing to increase in size posteriorly, they are longest over the hips, on the lower part of the back, and on the upper side of

the base of the tail; toward the end and on the sides of the tail, they pass again into long, thick bristles and stiff hairs. The lower surface of the body is clothed merely with brownish-black hair, scantily mixed with fur. The long, white-tipped hairs are generally most abundant on the head and the sides of the neck and shoulders and hips, disappearing entirely over the middle of the belly.

Different individuals vary greatly in respect to the abundance of the long light-tipped hairs, they being most abundant in the younger animals, in which they often give a decidedly whitish cast to the general color. In one specimen (No. 1309, M. C. Z. Coll.), the long bristly hairs are black, tipped occasionally with whitish. The pelage is very long and full, through which very few of the quills are visible. In another specimen (No. 5038, M. C. Z. Coll.), the exposed portion of the long bristly hairs is generally yellowish-white. In other specimens, there is a mixture of the wholly black, bristly hairs with those that are whitish-tipped. In young and full-pelaged specimens, the quills are generally entirely concealed; in the majority of the examples before me, they are visible on the head, sides of the neck, hinder part of the back, and the basal portion of the tail. In old specimens, in worn pelage, the spines are visible over most of the dorsal surface. The under-fur varies in different specimens from brownish-black to grayish. The young are born without quills, and of a uniform black color.

Full-grown specimens average about 35 to 40 inches in total length; the head about 6; tail (to end of vertebræ) about the same. Seventeen skulls, all of which have attained mature dentition, average 3.82 in length and 2.69 in breadth; nasals, 1.21; muzzle (from anterior border of intermaxillaries to the first molar), 1.29. As usual, there is a considerable range of variation in size, in color, and in the proportion of parts in specimens of corresponding ages. The few specimens in which the sex is known seem to indicate little, if any, strictly sexual variation in either size or color. Seven very old skulls vary in size as follows: length, 3.90 to 4.25; breadth, 2.60 to 3.00; nasals, 1.20 to 1.50; muzzle, 1.25 to 1.60. Three middle-aged skulls vary in length from 3.55 to 3.90; in breadth from 2.50 to 2.80; nasals from 1.12 to 1.33; muzzle from 1.12 to 1.30. Five younger skulls range in length from 3.40 to 3.65; in breadth from 2.35 to 2.60; nasals from 1.06 to 1.15; muzzle from 1.00 to 1.22. The largest skull measures 4.25 by 3.00; the smallest, 3.40 by 2.35. The nasals vary from 1.06 to 1.50 (in the very old skulls from 1.20 to 1.50); the muzzle from 1.00 to 1.62 (in the very old skulls from 1.25 to 1.62).

As usual, skulls of the same general size vary greatly in the relative size of different parts, and consequently in general form. Thus Nos 821 and 815 (M. C. Z. Coll.), measuring respectively 3.40 and 3.90 in length, have each a breadth of 2.60, while another specimen (No. 823, M. C. Z. Coll.), with the same length as No. 821, has a breadth of only 2.35. Specimens Nos. 815 and 816 (M. C. Z. Coll.), of essentially the same general size as respects length and breadth, vary remarkably in the form of the body of the skull, as shown by the following measurements:

Number.	Length.	Breadth.	Least distance between the orbits.	Length of nasals.	Width of nasals at fronto-interorbitalary sulci.	Width of nasals at anterior end.
815	3.00	2.60	0.85	1.93	0.50	0.70
816	3.05	2.70	1.08	1.38	0.72	0.88

No. 816 is a rather short, broad, stout skull, while No. 815 is remarkably narrow and attenuated, with an unusually great expansion of the zygomatic arches. While the total breadth differs but little, the body of the skull in 815 is fully one-eighth narrower than in 816, with a correspondingly less capacity. This is indicated by the lesser interorbital breadth and narrower nasals in 815, as is shown by the above given comparative measurements. The measurements, however, inadequately express the great contrast in form between these two examples—a difference that might ordinarily be regarded as sufficient to indicate well-marked specific diversity. Both are from the same locality, Oxford County, Maine.

Var. EPIXANTHUS.

*Western Porcupine.*

Similar in external appearance to var. *dorsatus*, but with the light tips of the long hairs pale greenish-yellow rather than yellowish-white. Nasals broader and longer.

The Porcupines from the region west of the Missouri River differ externally from those of the eastern half of the continent almost wholly through a slight difference in the color of the lighter portions of the long hairs of the dorsal surface, which have a greenish-yellow tint instead of yellowish-white. The few examples before me of this variety have also a greater profusion of

the long, light-tipped hairs than is commonly seen in eastern specimens. The more tangible difference consists in the relatively larger size of the nasals, which not only are rather longer, as pointed out by Professor Baird, but are also broader, and consequently larger. While the general size of the skull is the same in the two forms, the nasals in var. *epixanthus* average 1.50 in length, against 1.21 in var. *dorsatus*, and 0.88 in width at the anterior end against 0.75 for the same measurement in var. *dorsatus*. In var. *epixanthus*, the average length of the nasals in fourteen skulls exceeds the interorbital breadth of the skull, being a little over one-third (0.36) of the length of the skull; in var. *dorsatus* their average length in seventeen skulls is only equal to the interorbital breadth of the skull, or rather less than one-third (0.32) the length of the skull. Different individuals, however, vary greatly in respect to the length of the nasals, in var. *dorsatus* they ranging from 1.06 to 1.50, and in var. *epixanthus* from 1.20 to 1.75. In var. *dorsatus*, they exceed 1.33 in one specimen only, and 1.30 in only three, while in five examples they fall below 1.15; in var. *epixanthus*, three only fall below 1.30, while five attain or exceed 1.60.

The series of skulls of var. *epixanthus* presents about the same degree of individual variation as already noted under var. *dorsatus*, the largest example measuring 4.40 in length by 3.08 in breadth, and the smallest 3.30 by 2.47. In ten very old skulls, the variation ranges from 3.85 to 4.40 in length, and from 2.80 to 3.08 in width; nasals, 1.38 to 1.75. In eight middle-aged skulls, the variation ranges from 3.30 to 3.70 in length, and from 2.47 to 2.87 in breadth; nasals, 1.20 to 1.45. In both varieties, the animal increases greatly in size after the mature dentition is acquired. Specimens of corresponding ages of the two varieties in question present no material difference in size.

In respect to geographical variation in specimens strictly corresponding in age, those from the northern parts of the United States are considerably larger than those from the Yukon and Peel's Rivers. Thus three very old skulls from the Yukon measure only 3.98 by 2.82, against 4.17 by 2.89 for six skulls of corresponding age from the United States (Montana, Idaho, and Wyoming). Five middle-aged skulls from the Yukon and Peel's Rivers average 3.64 in length, while five skulls from Maine (var. *dorsatus*) average 3.73.

#### GENERAL REMARKS ON ERETHIZON DORSATUS AND ITS VARIETIES.

GEOGRAPHICAL DISTRIBUTION.—The Eastern or Canada Porcupine was formerly found throughout the greater part of New England and New York

and westward to Northern Ohio. It also extended southward along the Alleghanies through Pennsylvania, and possibly into Virginia and the mountainous portions of Eastern Kentucky.\* It seems not to have occurred in the immediate vicinity of the sea-coast south of Maine, but existed in Western and Central New England southward to Connecticut. It seems also to have been absent from Southeastern New York, and southward from nearly all of the region east of the Alleghanies. It was found south of the Great Lakes over most of the region north of the Ohio,† in Northern Pennsylvania and Western New York, and in the mountainous districts farther south. As late as 1813, it was still to be found in the western part of Saratoga County, New York.‡ Being an animal of the forest, it has shared the fate of other forest animals, and has already disappeared over considerable portions of its former habitat, particularly along its southern border. In New England, it is rarely found south of Central Maine and Northern New Hampshire, but ranges, west of the Connecticut River, still nearly or quite to the Massachusetts line. In 1840, Dr. Emmons gave it as common in the vicinity of Williamstown, Massachusetts.§ An isolated colony still survives on the slopes of Mount Monadnock in Southern New Hampshire, and it is also still found in portions of Pennsylvania. Probably its former southern range extended generally nearly or quite to the southern boundary of the Alleghanian fauna.

To the northward, its range extended nearly or quite to the limit of trees, and to the westward probably to the eastern border of the Great Saskatchewan Plains, where it passes gradually into the western variety. Hearne, however, eighty years since, spoke of it as being scarce north of Churchill River, where he met with only six individuals during a residence of six years.

The western form (var. *epixanthus*) still extends southward, in the mountains, to New Mexico and Arizona, and may probably be found in suitable

\* DeKay, probably on the authority of Catesby, gives its range as extending to the northern parts of Virginia and Kentucky (Nat. Hist. of New York, pt. 1, p. 79); but Audubon and Bachman state that they had "sought for it without success in the mountains of Virginia, and could never hear of it in Kentucky". Prof. N. S. Shaler also informs me that he has also failed to hear of it here, although this region one would naturally expect would come within its earlier range.

† Godman, on the authority of Dr. Best, says the "porcupine is seldom found in Ohio south of Dayton"; but that they were then still (in 1836) numerous on the Saint Mary's River (Godman, *Amer. Nat. Hist.*, vol. ii, p. 159). Dr. J. M. Wheaton informs me that a few still survive in Clark, Champaigne, and Ross Counties, and that it was common ten years since in Putnam County. Mr. E. W. Nelson writes me that the Porcupine was formerly rather common, though never abundant, in all of the wooded region north of the Ohio River, but that it is not now found (west of Ohio) south of the forests of Northern Wisconsin and Northern Michigan.

‡ Audubon and Bachman, *Quad. N. Amer.*, vol. i, p. 286.

§ *Quad. Mass.*, p. 72.



localities south of the Mexican boundary. To the westward it ranges to the Pacific, from California northward to Alaska, and doubtless extends northward to the limit of trees. It is extremely abundant in the wooded mountainous portions of Colorado, where, as I am informed by Dr. Coues, who speaks from reports given him on the spot, it sometimes becomes a considerable article of diet. The same naturalist also found it no less numerous in the Sweetgrass Hills, or "Three Buttes" of Northern Montana, where numerous individuals were secured. Though chiefly a woodland animal, it is not seldom seen ranging the prairie many miles from the nearest timber—perhaps traveling from one feeding ground to another.

TABLE I.—Measurements of seventeen skulls of *ERETHIZON DORSATUS* var. *DORSATUS*.

Catalogue-number.	Original number.	Locality.	Sex.	Total length.	Greatest width.	Distance between orbits.	Nasal bones, length.	Nasal bones, width behind.	Nasal bones, width before.	Upper incisors from front to molars.	Upper incisors from front to hinder margin of palate.	Upper molars, length taken together.	Lower jaw, length.	Lower jaw, height.	Remarks.
3256	...	Essex County, N.Y.	...	3.95	2.65	1.63	1.36	0.52	0.77	1.25	1.65	1.00	2.70	1.40	Very old.
3066	...	do	...	4.15	2.80	1.20	1.90	0.63	0.77	1.45	2.30	1.10	2.05	1.40	...do.
676	...	Pennsylvania	...	3.55	2.50	1.00	1.90	0.59	0.67	1.12	1.75	0.97	2.63	1.90	Middle-aged.
*819	...	Norway, Me.	...	4.25	2.90	1.25	1.32	0.70	0.85	1.50	2.37	1.03	3.05	1.50	Very old.
*820	...	Umbagog Lake, Me.	...	3.90	2.60	1.46	1.53	0.72	0.75	1.25	2.00	1.00	2.75	1.20	Middle-aged.
*821	...	do	...	3.40	2.60	1.17	1.15	0.60	0.70	1.00	1.72	1.02	2.47	1.30	Rather young.
*822	...	do	...	3.65	...	1.00	1.10	0.65	0.70	1.24	1.95	1.00	2.05	1.35	...do.
*823	...	Upton, Me.	...	3.40	2.35	1.10	1.08	0.60	0.74	1.12	1.67	0.93	2.43	1.23	...do.
*824	...	do	♀	3.52	2.57	1.12	1.06	0.62	0.70	1.10	1.73	0.93	2.53	1.18	Rather young; first molar just in sight.
*825	...	do	♀	3.65	2.50	1.10	1.13	0.58	0.68	1.10	1.83	1.03	2.75	1.20	...do.
*826	...	do	♀	3.80	2.70	1.25	1.90	0.60	0.80	1.30	2.65	0.97	2.80	1.35	Middle-aged.
*827	...	do	...	3.75	2.72	1.07	1.12	0.67	0.75	1.25	2.03	1.03	2.80	1.33	...do.
*828	...	do	...	3.65	2.70	1.10	1.50	0.60	0.70	1.25	1.95	0.97	2.65	1.35	...do.
*815	...	Norway, Me.	...	3.90	2.60	0.85	1.23	0.50	0.70	1.40	2.03	0.94	3.00	1.33	Very old.
*816	...	do	...	3.95	2.70	1.08	1.22	0.72	0.82	1.37	2.03	1.06	2.90	1.33	...do.
*813	...	Upton, Me.	♂	4.25	3.00	1.25	1.97	0.73	0.73	1.57	2.30	1.12	3.03	1.35	...do.
*865	...	do	♂	4.25	2.85	1.10	1.50	0.75	0.95	1.64	2.50	1.10	3.00	1.45	...do.

\* In the Museum of Comparative Zoology, Cambridge, Mass.

† From front edge of the intermaxillaries to the occipital condyles.

TABLE II.—Measurements of eighteen skulls of ERETHIZON DORSATUS var. EPIXANTHUS.

Catalogue number.	Original number.	Locality.	Sex.	Total length.*	Greatest width.	Distance between orbits.	Nasal bones, length.	Nasal bones, width behind.	Nasal bones, width before.	Upper incisors from front to molars.	Upper incisors from front to hinder margin of palate.	Upper molars, length taken together.	Lower jaw, length.	Lower jaw, height.	Remarks.
6598	281	Fort Yukon.....	♂	3.25	2.90	1.28	1.38	0.80	0.92	1.27	1.97	1.09	3.10	1.50	Very old.
6165	.....	Yukon River.....	.....	4.63	2.85	1.29	.....	.....	.....	1.31	2.60	0.93	3.18	1.50	...do.
6104	.....	do.....	.....	4.06	2.81	1.33	1.55	0.75	0.69	1.30	2.20	1.05	3.14	1.45	...do.
6108	.....	do.....	.....	3.99	2.77	1.14	.....	.....	.....	1.29	2.10	1.03	3.12	1.40	Middle-aged.
6106	.....	do.....	.....	3.67	.....	1.30	.....	.....	.....	1.20	1.90	1.03	2.85	1.30	...do.
8948	1313	Alaska.....	.....	3.30	2.47	1.25	.....	.....	.....	1.06	1.62	0.92	2.85	1.20	...do.
6237	56	Peel's River.....	♂	3.70	2.87	1.25	1.46	0.75	0.65	1.30	2.08	1.00	2.90	1.35	...do.
6238	.....	do.....	♂	3.60	.....	1.06	1.28	0.68	0.75	1.20	1.85	0.95	2.80	1.37	...do.
13405	.....	Idaho.....	.....	3.75	2.75	1.30	1.45	0.90	0.95	1.37	2.18	1.02	2.80	1.40	...do.
3657	.....	Fort Bridger.....	.....	4.40	3.08	1.35	1.75	0.87	1.02	1.48	2.58	1.20	.....	.....	Very old.
11564	.....	Wyoming.....	.....	4.10	2.85	1.20	1.50	0.80	0.95	1.42	2.27	1.10	3.00	1.50	...do.
6883	.....	do.....	.....	.....	1.63	1.25	0.62	0.78	1.25	1.90	0.97	2.85	.....	.....	Middle-aged.
9595	.....	Republican Fork, Kans.	♂	4.20	2.80	1.23	1.75	0.70	0.95	1.45	2.23	1.10	3.10	1.50	Very old.
9594	.....	do.....	.....	4.10	2.80	1.30	1.60	0.68	.....	1.25	2.12	1.05	2.90	1.55	...do.
3080	.....	Utah.....	.....	4.00	3.03	1.18	1.60	0.75	0.85	1.33	2.25	1.10	3.15	1.53	...do.
13077	.....	Three Buttes, Mont.	♀	4.20	2.80	1.10	1.65	0.67	0.87	1.40	2.20	1.03	3.10	1.40	...do.
13078	.....	do.....	♀	3.90	.....	1.90	1.60	0.75	0.93	1.33	2.15	1.05	2.87	1.55	...do.†
6501	.....	Fort Whipple, Ariz.	.....	3.35	2.57	1.00	1.90	0.83	0.73	1.10	1.77	0.95	2.50	1.17	Middle-aged.

\* From front edge of intermaxillaries to occipital condyles.

† The oldest of the series.

TABLE III.—*List of specimens of ERETHIZON DORSATUS var. DORSATUS.*

Catalogue-number.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
*1549	.....	.....	Oxford County, Me.....	.....	A. E. Verrill ..	J. G. Rich.....	Skul.
*1550	.....	.....	do.....	.....	do.....	do.....	do.
*1551	.....	.....	do.....	.....	do.....	do.....	do.
*1552	.....	.....	do.....	.....	do.....	do.....	do.
*5038	.....	.....	do.....	.....	do.....	do.....	do.
*1428	.....	.....	do.....	Feb. —, 1865	J. G. Rich ..	do.....	do.
*1365	.....	.....	do.....	.....	B. D. Verrill ..	B. D. Verrill ..	do.
*1340	.....	.....	do.....	.....	do.....	do.....	do.
*1367	.....	.....	do.....	Feb. 29, 1860	do.....	do.....	do.
*1368	.....	.....	do.....	June 6, 1860	do.....	do.....	do.
*1369	.....	.....	do.....	Mar. 12, 1860	do.....	do.....	do.
*809	.....	.....	do.....	Mar. —, 1860	do.....	do.....	Skull.
*810	.....	.....	do.....	Mar. —, 1860	do.....	do.....	do.
*811	.....	.....	do.....	Mar. —, 1860	do.....	do.....	do.
*812	.....	.....	do.....	Mar. —, 1860	do.....	do.....	do.
*813	.....	.....	do.....	.....	J. G. Rich ..	J. G. Rich ..	do.
*814	.....	.....	do.....	.....	A. E. Verrill ..	A. E. Verrill ..	do.
*815	.....	.....	do.....	.....	do.....	do.....	do.
*816	.....	.....	do.....	.....	do.....	do.....	do.
*817	.....	.....	do.....	.....	do.....	do.....	do.
*818	.....	.....	do.....	.....	do.....	do.....	do.
*819	.....	.....	do.....	.....	do.....	do.....	do.
*820	.....	.....	do.....	.....	do.....	do.....	do.
*821	.....	.....	do.....	.....	do.....	do.....	do.
*822	.....	.....	do.....	.....	do.....	do.....	do.
*823	.....	.....	do.....	.....	J. G. Rich ..	J. G. Rich ..	do.
*824	.....	.....	do.....	.....	do.....	do.....	do.
*825	.....	.....	do.....	.....	do.....	do.....	do.
*826	.....	.....	do.....	.....	do.....	do.....	do.
*827	.....	.....	do.....	.....	do.....	do.....	do.
*828	.....	.....	do.....	.....	do.....	do.....	do.
*829	.....	.....	do.....	.....	do.....	do.....	do.
676	.....	.....	Pennsylvania.....	.....	do.....	do.....	do.
8356	.....	.....	Essex County, N. Y.....	.....	do.....	do.....	do.
3066	.....	.....	do.....	.....	do.....	do.....	do.

\* In the Museum of Comparative Zoology, Cambridge, Mass.

TABLE IV.—List of specimens of *ERETHIZON DORSATUS* var. *EPIKANTHUS*.

Catalogue-number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
.....	.....	1598	♂	Yukon, mouth of Porcupine.	.....	R. Kennicott.....	R. Kennicott.....	Skin.
.....	6588	281	.....	Fort Yukon.....	.....	.....do.....	.....do.....	Skull.
.....	6105	.....	.....	Yukon.....	.....	.....do.....	.....do.....	.....do.
.....	6104	.....	.....	.....do.....	.....	.....do.....	.....do.....	.....do.
.....	6108	.....	.....	.....do.....	.....	.....do.....	.....do.....	.....do.
.....	6106	.....	.....	.....do.....	.....	.....do.....	.....do.....	.....do.
.....	6107	.....	.....	.....do.....	.....	.....do.....	.....do.....	.....do.
.....	6949	.....	.....	Alaska.....	.....	.....do.....	.....do.....	.....do.
.....	6230	.....	♀	Peel's River.....	.....	C. P. Gandet.....	C. P. Gandet.....	.....do.
.....	6237	56	.....	.....do.....	.....	.....do.....	.....do.....	.....do.
.....	6238	.....	.....	.....do.....	.....	.....do.....	.....do.....	.....do.
.....	13405	.....	♀	Henry's Lake, Idaho.....	Aug. 10, 1873	Dr. F. V. Hayden	C. H. Merriam.....	.....do.
.....	3705	3657	.....	Fort Bridger.....	.....	.....do.....	Dr. F. V. Hayden	Skull and skin.
.....	11631	.....	.....	Wyoming.....	.....	.....do.....	.....do.....	Skull.
.....	11599	.....	.....	.....do.....	.....	.....do.....	.....do.....	.....do.
.....	13025	13978	♀	Three Buttes, Mont.....	Aug. 31, 1873	A. Campbell.....	Dr. E. Coues.....	Skull and skin.
.....	13024	13977	♀	.....do.....	Aug. 1, 1873	.....do.....	.....do.....	.....do.
.....	1807	2595	♂	Republican Fork, Kans.	Oct. 7, 1856	Lieut. F. T. Bryan	W. S. Wood.....	.....do.
.....	1896	2594	.....	.....do.....	Oct. 7, 1856	.....do.....	.....do.....	.....do.
.....	4369	.....	.....	Nebraska.....	.....	Dr. F. V. Hayden	Dr. F. V. Hayden	Skull.
.....	7614	6501	.....	Fort Whipple, Ariz.	.....	Dr. E. Coues.....	Dr. E. Coues.....	Skull and skin.
.....	348	1868	.....	Bill Williams's Fork, N. Mex.	.....	Capt. A. W. Whipple	.....do.....	.....do.
*2864	.....	1704	.....	Percy, Wyo.....	.....	Rocky Mt. Exped.	J. A. Allen.....	Skin.
*2865	.....	1731	.....	.....do.....	.....	.....do.....	.....do.....	.....do.

\* In the Museum of Comparative Zoology, Cambridge, Mass.

## EXTINCT NORTH AMERICAN PORCUPINES.

Two forms of extinct North American Porcupines have thus far been indicated, described in each case from detached teeth. Hence their relationship to the existing species is very imperfectly known.

Dr. Leidy has described\* a species from two detached molar teeth, discovered by Dr. Hayden in the Pliocene deposits of Dakota, which he refers to *Hystrix*, under the name *Hystrix venustus*. Of these teeth, Dr. Leidy says: "They apparently indicate a species of Porcupine, but in structure are unlike those of the recent American Porcupine, *Erethizon dorsatus*, and exhibit a more evident relationship with those of the Crested Porcupine, *Hystrix cristata* of Europe." As is well known, the genus *Hystrix* belongs to a very different group from the Porcupines of the New World, and has not been

\* Journ. Acad. Nat. Sci. Phil., 2d ser., v, 1869, 343; U. S. Geol. Survey of Wyoming for 1870 (1871), 364.

heretofore known to occur in America. Should the *Hystrix venustus* of Leidy prove to really belong to the true *Hystrixinae*, it brings this group for the first time into the North American fauna.

The other species of extinct Porcupine was described by Professor Cope from teeth found in the Port Kennedy bone-cave, under the name of *Erethizon cloacinum*.

#### ERETHIZON CLOACINUS Cope.

*Erethizon cloacinum* COPE, Proc. Amer. Phil. Soc., xli, 1871, 93, fig. 19.

This species is described from "a last superior molar of the left side and a portion of one of the inferior incisors". The molar tooth is represented as differing from the corresponding tooth of *Erethizon dorsatus* in two important particulars: "One of these is the greater vertical depth of the external inflection of enamel", which "is nearly as deep as the internal, while in *E. dorsatum* it is much shallower, the internal extending down to the alveolar border." This, however, is a feature which I find to be very variable in *E. dorsatus*, sometimes presenting just the appearance claimed to characterize *E. cloacinus*. The other character is the possession of two enamel islands, or annuli, in the posterior half of the triturating surface, while only one occurs in any of the large series of specimens of *E. dorsatus* now before me. "The size of the teeth in *E. cloacinum*," says Professor Cope, "are about equal to the largest seen in the *E. dorsatum*." The specimens were found associated with the remains of different species of *Megalonyx*, *Myiodon*, *Mastodon*, *Tapirus*, *Ursus*, *Meleagris*, several species of extinct *Coleoptera*, etc., with which were mingled those of *Lepus sylvaticus*, a Squirrel closely allied to *Sciurus hudsonius*, and several extinct species of *Arvicola*.

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MONOGRAPHS  
OF  
NORTH AMERICAN RODENTIA.

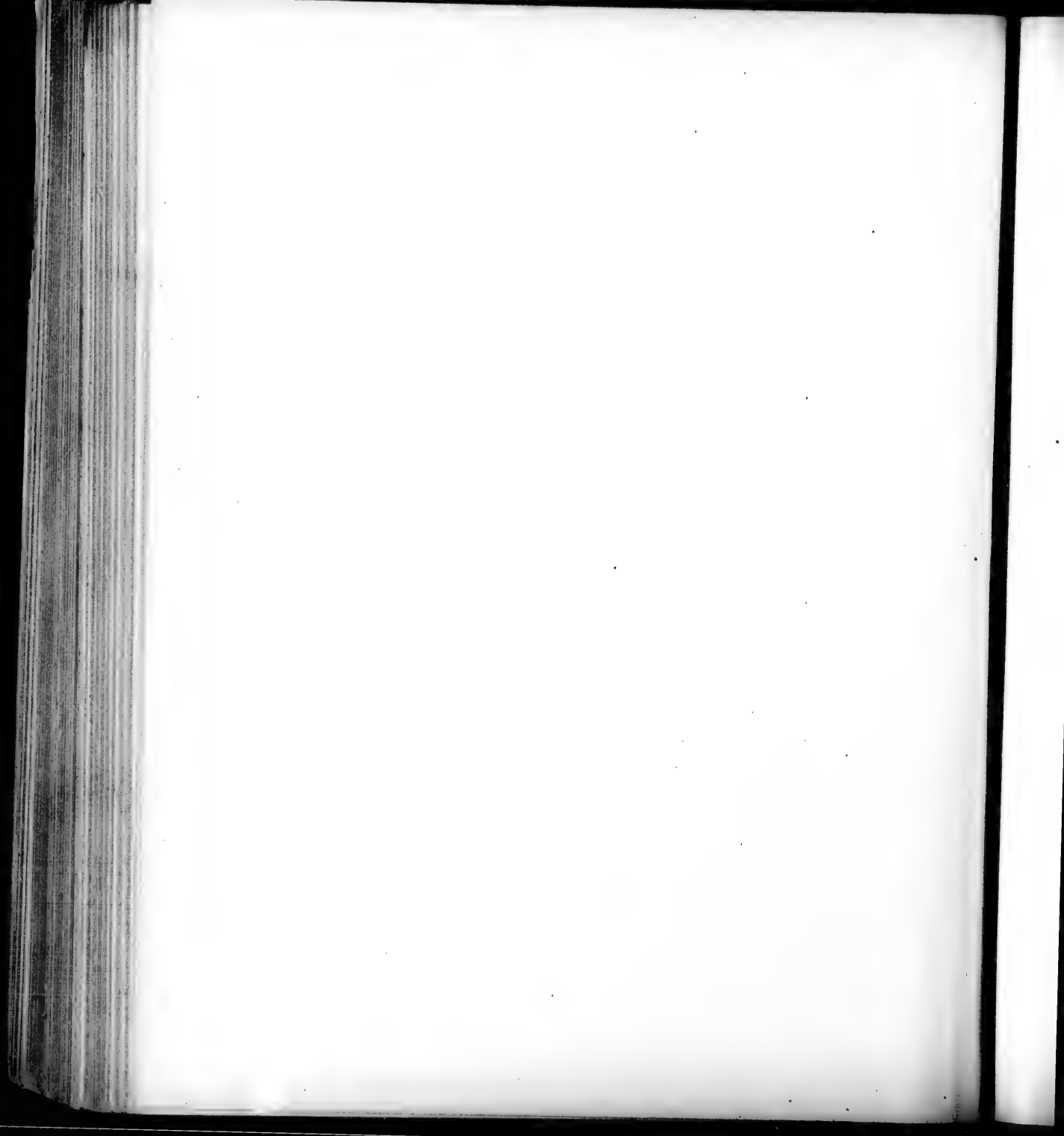
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No. IV.—LAGOMYIDÆ.

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By J. A. ALLEN.

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## LETTER OF TRANSMITTAL.

[Covering *Lagomyidæ*, *Castoroididæ*, and *Castoridæ*.]

CAMBRIDGE, MASS., November 8, 1876.

SIR: I transmit herewith for publication my articles on the families *Castoroididæ*, *Castoridæ*, and *Lagomyidæ*. The first (*Castoroididæ*) is represented, so far as at present known, by the single extinct species *Castoroides ohioensis*; the second (*Castoridæ*) by one living species (*Castor fiber*) and several extinct ones; the third (*Lagomyidæ*) by the single living species *Lagomys princeps*.

The materials on which these reports are based are contained mainly in the National Museum at Washington. I am, however, indebted to the Museum of Comparative Zoölogy for important additional materials, and have been further greatly aided by specimens kindly loaned me by the Boston Society of Natural History. I have also been kindly permitted to examine the specimens of the extinct species of *Castoridæ* described by Dr. Leidy, contained in the Museum of the Academy of Natural Sciences of Philadelphia. The forms described by Professor Cope I know as yet only from his published descriptions and figures.

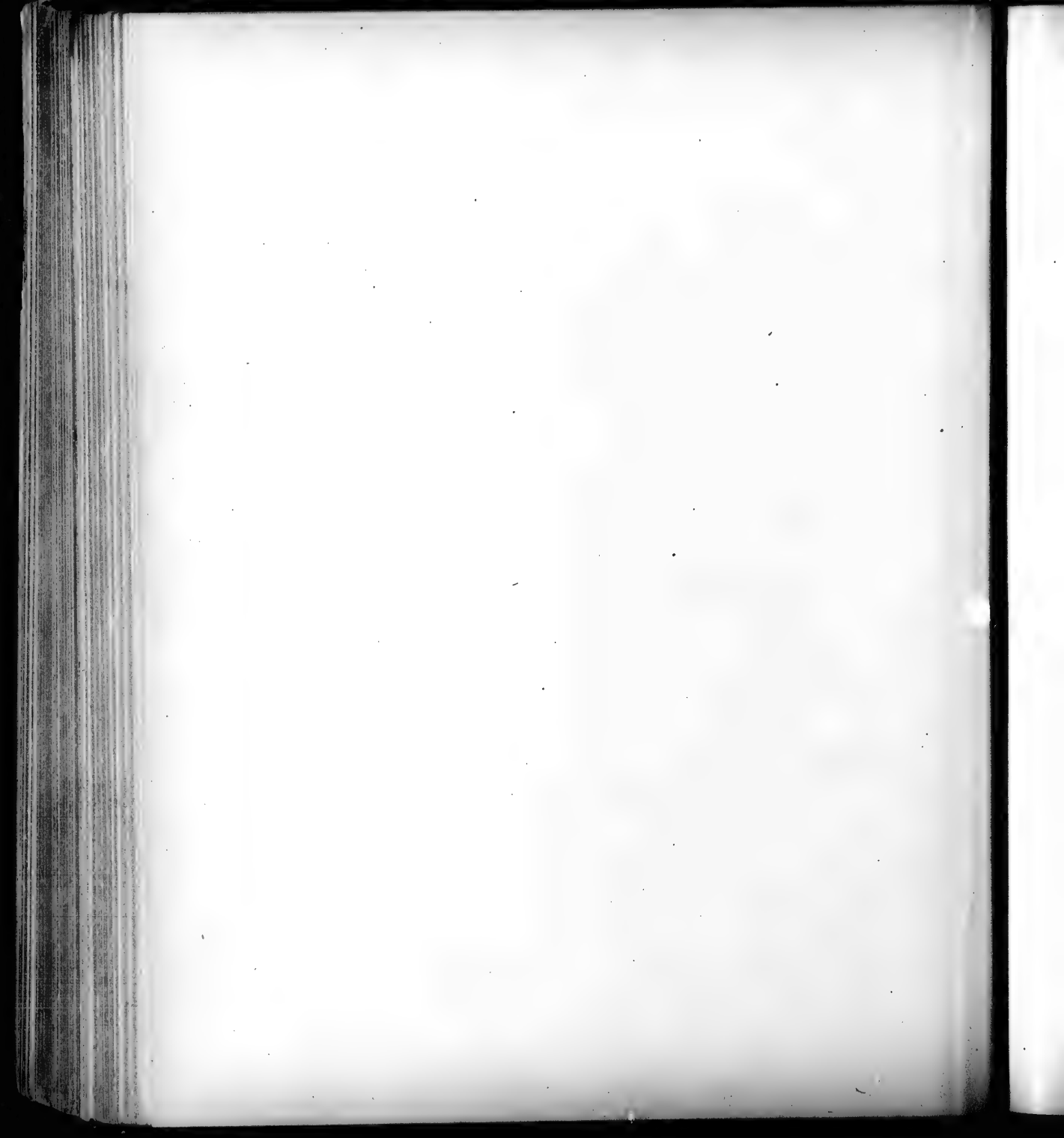
I am, Sir, very respectfully, yours,

J. A. ALLEN.

Dr. F. V. HAYDEN,

*United States Geologist, etc., etc., Washington, D. C.*





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## FAMILY LAGOMYIDÆ.

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The dentition of the Pikas (*Lagomyidæ*) closely resembles that of the Hares (*Leporidae*), with which family they were for a long time associated. In other respects, however, the two groups differ widely. In the Pikas, the dorsal outline of the skull is gently arched, the occipital portion being but slightly below the plane of the interorbital region, instead of being greatly depressed, as in the Hares. The orbits are much smaller and open more upwardly, and the zygomatic processes arise at a much higher level; the axis of the malar bone is rather above the middle of the skull instead of much below it. The postorbital processes, so largely developed in the Hares, are wanting, and the malar bone is prolonged far beyond the posterior zygomatic process, reaching nearly to the auditory opening. In general form, the skull is depressed or flattened, greatly expanded posteriorly, and narrowed anteriorly. There is a well-developed sagittal crest posteriorly, and the interparietal does not form a raised tabular platform as in *Lepus*. The facial portion of the maxillaries is pierced by a single large opening instead of by numerous small ones. The auditory bullæ are greatly expanded, and open laterally by a large orifice, instead of upwardly and posteriorly. The foramen magnum is relatively much larger, and the paroccipital processes, so prominent in the Hares, are undeveloped. The pterygoid processes are much as in *Lepus*, but their wings are more divergent and inclose broader fossæ. The basi-sphenoid is not perforate, and is not separated by a fissure from the vomer. The anterior incisive foramina are small, oval, and open near the base of the incisor teeth. The palatal portions of the intermaxillaries nearly meet along the mesial line, and have not the deep lateral sinuses seen in *Lepus*. The palate, as in *Lepus*, forms only a narrow bridge, but it is situated more posteriorly, and is wholly devoid of the pointed anterior

extension seen in the latter. The posterior palatine foramina form a large circular opening, which is not extended forward beyond the intermaxillo-maxillary suture. The palate, owing to the more depressed form of the skull, is much nearer the vomer than in *Lepus*. The angular process of the lower jaw is narrower, longer, and more recurved than in the Hares. The condylar process is broad and quadrate, and the condyles have a very great antero-posterior development, relatively four times greater than in *Lepus*; the coronoid process is placed lower, and forms a mere tubercle, with a second smaller tubercle near the last molar. The foramen mentum is remarkable for its posterior position, being about opposite the middle true molar, instead of considerably in advance of the first premolar, as is usually the case. The small posterior upper molar seen in *Lepus* is wanting; the remaining upper molars do not differ materially from those of *Lepus*, except that they are much more deeply grooved on the inner side. The lower molars, however, are very different from those of *Lepus*, they being so deeply divided by the lateral grooves that the triturating surface presents a series of acute triangles with open intervals, somewhat as in *Arvicola*. The cutting-edge of the front upper incisor is gouge-shaped instead of chisel-shaped, as in *Lepus* and most other Rodents, the cutting-edge being hollowed on the inner side. The anterior face is divided by a deep longitudinal groove into two unequal moieties, the outer of which is nearly three times as wide as the inner, and considerably longer, generally exceeding the inner, in *Lagomys princeps*, by about 0.05 of an inch. The cutting-edge is consequently deeply notched; the bottom of the notch, formed by the groove, being sometimes 0.12 of an inch below the outer edge. The lower incisors are rounded anteriorly, and lack the groove seen in the upper incisors.

The Pikas are nearly tailless, and the general form of the body and limbs is much as in the *Arvicola*. They hence lack the greatly disproportionate development of the hind limbs seen in the Hares. The clavicles are also well developed. The toes are five in front and four behind, armed with short, arched, compressed nails, and at the base of each toe is a prominent, naked pad. The pelage is much firmer than in the Hares, with less of the soft, downy under-fur, and more resembles the pelage of *Arvicola*. They are weak, sedentary animals, living among loose rocks in alpine localities, generally on or near the summits of high mountains, and are apparently strictly diurnal in their habits. They are social in their dispositions, living generally in com-

munities, and lay up a store of food for winter use. They sit erect like a Marmot, and utter frequently a sharp, shrill, barking cry. They are thus in their habits totally unlike the Hares.

A single species only is found in North America, which is confined to the higher parts of the mountains of the western half of the continent. The group is more numerous represented in Northern Asia, and is not now found elsewhere. Three species inhabit the elevated parts of Northern India, and three others occur farther northward. None occur west of the Black Sea, but they range thence eastward to Kamtschatka. Their habitat hence embraces only Western North America and Northern Asia. Formerly they extended much farther westward and southward; their fossil remains having been found in the Pliocene strata of England, France, and on the islands of Corsica and Sardinia. The species are apparently all referable to the single genus *Lagomys*. The Pikas are a less specialized form than the Hares.

#### -GENUS LAGOMYS G. Cuvier.

*Lagomys* CUVIER, Règne Anim., i, 1817, 219.

*Ocotoma* GRAY, Ann. & Mag. Nat. Hist., 3d ser., xx, 1867, 230 (type, *Lepus ootoma*, Pallas).

#### LAGOMYS PRINCEPS Richardson.

##### North American Pika.

##### SYNONYMY.

*Lepus (Lagomys) princeps* RICHARDSON, Zool. Journ., 1828, 520; Fauna Bor.-Amer., i, 1829, 227, pl. xix.—FISCHER, Syn. Mam. (add. 1830), 403 [603] (from Richardson).

*Lagomys princeps* WAGNER, Supp. Schreber's Säuget., iv, 1844, 123, pl. cccxxxix a (from Richardson).—WATERHOUSE, Nat. Hist. Mam., ii, 1843, 28.—AUDUDON & BACHMAN, North Amer. Quad., ii, 1851, 244, pl. lxxxiii (mainly from Richardson).—GIBBEL, Säuget., 1855, 455.—BAIRD, Mam. N. Amer., 1857, 619 (from Waterhouse).—COOPER, Proc. Cal. Acad. Nat. Sci., iii, 1863, 69; ib., 1868, 6 (Sierra Nevada, Cal.).—GRAY, Ann. & Mag. Nat. Hist., 3d ser., xx, 1867, 220.—COPE, Proc. Acad. Nat. Sci. Phil., 1868, 2 (Lower California).—ALLER, Bull. Essex Institute, vi, 1874, 57, 66.—COUES & YARROW, Wheeler's Expl. and Surv. west of the 100th Merid., v, Zool., 1875, 125.

*Lagomys minus* LORD, Proc. Zool. Soc. Lond., 1863, 93.—GRAY, Ann. & Mag. Nat. Hist., 3d ser., xx, 1867, 230.

##### DESCRIPTION.

Above grayish-brown, varied with black and yellowish-brown; sides yellowish-brown; below grayish, more or less strongly tinged with pale yellowish-brown.

The color varies greatly in different specimens, irrespective of age, sex, season, or locality. The dorsal surface is always more or less varied with black, through the prevalence of numerous black-tipped hairs, especially over

the back and rump. Anteriorly the black-tipped hairs are fewer, and the dorsal aspect, from the shoulders anteriorly to the nose, is generally more or less strongly tinged with pale yellowish-brown, in strong contrast with the remainder of the dorsal surface. The sides of the body are generally still more strongly washed with yellowish-brown, which, over the ventral surface, assumes a much paler tint. In young specimens, the black-tipped hairs are much fewer, and the pelage generally grayer. The ears, which are well haired on both surfaces, are grayish, tinged more or less with pale yellowish-brown, except anteriorly on the outer surface, where is a large dusky area. They have a well-marked whitish or yellowish-white margin. Anterior surface of all the feet yellowish-brown, nearly as bright as on the sides of the body. Soles of the hind feet dusky; palms pale yellowish-brown. Large naked black pads at the base of all the toes. Whiskers numerous, one to two and a half inches long; in some specimens nearly all black, in others only the upper are black, the lower being light-colored to the bases; generally a part have the basal portion black, with the apical half or two-thirds yellowish white.

A series of over thirty skins now before me, all taken at one locality and on the same day, show a great range of individual variation in color through the varying intensity of the fulvous suffusion. In some specimens, it is a very pale wash of yellowish-brown, while in others it is strongly yellowish, which, in still others, becomes decidedly rufous, especially on the sides of the neck and shoulders and on the top of the head. In one specimen (No. 2841, M. C. Z. Coll.), the whole upper surface of the head is bright chestnut, and the usual pale fulvous suffusion on other parts of the body is decidedly rufous, rather than fulvous. No. 2763 (M. C. Z. Coll.) is strongly tinged throughout with yellowish-brown. On the other hand, No. 2682 (M. C. Z. Coll.) has only a faint yellowish-brown tinge, which is scarcely perceptible on the ventral surface. These specimens are, however, all adult males. There is apparently no sexual difference in color; some of the palest specimens, as well as the brightest, being males. Young specimens differ from the adult in being generally more grayish, with fewer black-tipped hairs in the dorsal surface. The fulvous suffusion is generally paler, but in some specimens is as bright as in average adults.

The texture of the pelage is much as in the *Arvicola*, especially the large *A. xanthognathus*, being much firmer than in the Hares, with a much smaller amount of soft under-fur.

Length about 7.00, ranging in adult specimens from 6.50 to nearly 8.00. Ears broad, large, and rounded. Hind foot generally about 1.15 to 1.25 in adults; fore foot about 0.80. The black naked pads at the base of the toes are very prominent.

The skull ranges in length from about 1.70 to 1.88; breadth, 0.82 to 0.92; interorbital breadth, 0.21 to 0.25; average length of the nasals about 0.62, narrowing posteriorly from about 0.25 to 0.18. Lower jaw, length, 1.07 to 1.25; height 0.57 to 0.70. The series of skulls show a considerable range of variation in size in adult specimens. The bones of the skull are thin and papery, and often the parietal suture remains unclosed in fully adult skulls, and the cranial elements of the skull are never to any great extent ankylosed. The nasal bones, however, finally become firmly united.

The specimens on which the present article is based were all taken on the Snowy range, in Park County, Colorado, and all but two at one locality. The measurements of the animal were all taken in the field by myself, from fresh specimens.

#### GEOGRAPHICAL DISTRIBUTION.

The North American Pika inhabits the summits of the Rocky Mountains from Colorado far northward into British America. It is also found near the summit of the Wahsatch range in Utah, the Sierra Nevada in California, and the Cascade Mountains in Oregon. I found it very abundant near the limit of trees in the vicinity of Montgomery, Park County, Colorado,\* and Lieut. W. L. Carpenter has collected it at other neighboring points of the Snowy Range. Dr. J. G. Cooper found it near the limit of perpetual snow in the Sierra Nevada,† where he reports it as quite common over a limited district; while Professor Gabb met with it as far south as the northern boundary of Lower California (lat. 32°), at an altitude of about 10,000 feet.‡ Mr. J. K. Lord met with it (his "*Lagomys minimus*"§) near the summits of the Cascade Mountains at an altitude of about 7,000 feet above sea-level, and also at Chilokweyuk Lake, on the western slope of the Cascades || Dr.

\* Bull. Essex Institute, vol. vi, pp. 56, 66.

† Proc. Cal. Acad. Nat. Sci. vol. iii, p. 69; *ib.*, 1868, p. 6.

‡ Proc. Acad. Nat. Sci. Philad., 1868, 2.

§ The characters Mr. Lord gives for his "*Lagomys minimus*" do not indicate any specific difference while the habits he attributes to it are exactly those of the *L. princeps* as recorded by a number of independent observers. He recognized *L. princeps* as occurring near the same locality; but, because he saw no evidence of *L. princeps* carrying leaves and grass into its warrens, he regarded the animals seen at the two neighboring localities as distinct species. His "*Fiber oregonensis*", described in the same paper, rests on similar mistaken assumptions.

|| Proc. Zool. Soc. Lond., 1863, pp. 96, 97.



Richardson, traced it along the Rocky Mountains from latitude  $52^{\circ}$  to  $60^{\circ}$ , and Mr. Nuttall met with it as far south in the Rocky Mountains as latitude  $42^{\circ}$ .\* Dr. Coues met with it in the Rocky Mountains, at latitude  $49^{\circ}$  N., at an elevation of only about 4,500 feet, at the level of Waterton or Chief Mountain Lake, where the animals were very numerous in the débris at the foot of cliffs.

Their habits seem everywhere much the same. The animals are everywhere found in communities, living among the loose rocks from a little below timber-line nearly up to the snow-line. They appear to rarely wander many yards from their homes; are timid, yet easily become familiar. Though retreating to their holes when first alarmed, they soon come cautiously out, one after another, till one may hear their sharp little cries in every direction. Their color so nearly resembles that of the rocks they live among that they are not easily seen, and their cry is of such a character as to easily mislead one in respect to the point from which it proceeds, seeming to be far away when really only a few feet distant. They sit erect like little Marmots, and in no way resemble the Hares in habits. They carry into fissures of the rocks large quantities of grass, which they lay up for winter consumption. Dr. Coues informs me that they "may be readily taken in any simple trap", and adds, that they "do not hibernate, at least southerly".

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\*Audubon and Bachman's Quad. North Amer., vol. II, p. 247.

## LAGOMYIDÆ-LAGOMYS-MEASUREMENTS.

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TABLE I.—Measurements of thirty-nine specimens of LAGOMYS PRINGERS.

Catalogue number.	Original number.	Locality.	Sex.	From tip of nose to—					Length of—		Nature of specimen.
				Eye.	Ear.	Occiput.	Tail.	Fore foot.	Hind foot.		
3673	838	Montgomery, Colo .....	♂	0.70	1.75	1.75	5.75	0.75	1.07	Measured in the flesh.	
3676	861	do .....	♂	1.00	2.05	2.15	7.25	0.80	1.30	do.	
3677	863	do .....	♂	0.95	2.05	2.05	7.50	0.75	1.23	do.	
3678	863	do .....	♂	0.95	1.87	1.75	6.35	0.80	1.10	do.	
3679	864	do .....	♂	0.95	1.98	1.90	6.90	0.85	1.30	do.	
3680	865	do .....	♂	0.90	1.90	1.90	7.00	0.80	1.30	do.	
3681	866	do .....	♂	0.92	2.00	2.00	7.25	0.82	1.30	do.	
3682	867	do .....	♂	0.85	1.95	1.95	7.60	0.77	1.17	do.	
3683	869	do .....	♂	0.77	1.77	1.77	6.90	0.77	1.15	do.	
3674	859	do .....	♂	0.85	1.85	1.85	7.50	0.82	1.00	do.	
3686	871	do .....	♂	0.68	1.47	1.47	5.85	0.75	1.08	do.	
3674	859	do .....	♂	0.70	1.50	1.75	5.75	0.75	1.07	do.	
3687	872	do .....	♂	0.80	2.03	2.03	7.50	0.80	1.15	do.	
3688	874	do .....	♂	0.97	2.12	2.12	7.00	0.87	1.18	do.	
3690	876	do .....	♂	0.90	2.15	2.15	7.15	0.87	1.23	do.	
3672	878	do .....	♂	0.85	1.83	1.83	7.00	0.89	1.30	do.	
3683	879	do .....	♂	0.95	2.00	2.00	7.25	0.87	1.30	do.	
3685	881	do .....	♂	0.90	2.15	2.15	7.60	0.85	1.25	do.	
3694	890	do .....	♀	0.90	2.05	2.05	7.60	0.85	1.30	do.	
3675	890	do .....	♀	0.97	1.80	2.00	6.85	0.85	1.27	do.	
3683	894	do .....	♀	0.92	2.05	2.05	7.40	0.80	1.06	do.	
3687	873	do .....	♀	0.95	1.90	1.90	7.70	0.88	1.15	do.	
3699	875	do .....	♀	0.90	1.95	1.95	7.70	0.85	1.30	do.	
3691	877	do .....	♀	0.80	1.82	1.82	7.40	0.92	1.20	do.	
3687	884	do .....	♀	1.05	2.06	2.06	6.90	0.85	1.22	do.	
3698	889	do .....	♀	0.85	1.90	1.90	7.00	0.92	1.25	do.	
3399	890	do .....	♂	0.90	1.90	1.90	7.90	0.90	1.12	do.	
3700	891	do .....	♂	0.92	1.90	1.90	6.45	0.90	1.12	do.	
3696	892	do .....	♂	0.85	1.90	1.90	6.90	0.90	1.00	do.	
337	893	do .....	♂	0.92	1.92	1.92	6.60	0.90	1.12	do.	
338	893	do .....	♂	0.90	1.92	1.92	6.75	0.92	1.05	do.	
339	893	do .....	♂	0.95	2.05	2.05	7.50	0.95	1.30	do.	
340	893	do .....	♂	0.92	1.92	1.92	6.50	0.92	1.30	do.	
341	893	do .....	♂	0.90	1.90	1.90	6.80	0.95	1.08	do.	
342	893	do .....	♂	0.92	2.05	2.05	7.10	0.92	1.17	do.	
343	893	do .....	♂	0.90	1.90	1.90	7.90	0.90	1.17	do.	
344	893	do .....	♂	0.90	1.90	1.90	7.90	0.90	1.24	do.	
345	893	do .....	♂	0.92	2.04	2.04	7.15	0.95	1.18	do.	
346	893	do .....	♂	0.75	1.65	1.65	5.75	0.78	1.10	do.	

TABLE II.—Measurements of fourteen skulls of *LAGOMYS PRINCEPS*.

Catalogue-number.	Original number.	Locality.	Sex.	Total length.	Greatest width.	Distance between orbits.	Nasal bones, length.	Nasal bones, width behind.	Nasal bones, width before.	Upper incisors from front to molars.	Upper incisors, height.	Upper incisors, width between external edges at base.	Upper molars, length taken together.	Upper molars, distance between posteriorly.	Lower jaw, length.	Lower jaw, height.
944	...	Montgomery, Colo	...	1.84	0.68	0.21	0.02	0.90	0.25	0.98	...	...	0.37	0.58	...	...
951	...	do	...	1.72	0.62	0.23	...	...	...	0.58	...	...	0.37	0.56	...	...
946	...	do	...	1.86	0.67	0.24	...	...	...	0.50	...	...	0.34	0.52	...	...
980	...	do	...	1.85	0.69	0.21	0.01	0.18	0.27	0.67	0.21	0.23	0.37	0.56	...	...
945	...	do	...	1.88	0.70	0.25	0.02	0.19	0.25	0.53	0.30	0.25	0.36	0.56	...	...
954	...	do	...	1.07	0.49	0.24	...	...	...	0.48	...	...	0.38	0.56	...	...
943	...	do	...	1.73	0.59	0.23	...	...	...	0.50	...	...	0.33	0.55	...	...
933	...	do	...	1.77	0.51	0.24	...	...	...	0.58	...	...	0.35	0.55	...	...
949	...	do	...	1.70	0.53	0.21	...	...	...	0.48	0.26	0.21	0.34	0.56	...	...
957	...	do	...	1.78	0.53	0.23	...	...	...	0.50	0.27	0.20	0.34	0.58	...	...
948	...	do	...	1.72	0.53	0.21	...	...	...	0.48	...	...	0.35	0.58	...	...
955	...	do	...	1.75	0.53	0.23	...	...	...	0.48	0.25	0.26	0.38	0.51	...	...
13287	...	Buffalo Mountain, Colo	♀	1.78	0.61	0.21	0.00	0.16	0.20	0.58	0.25	0.20	0.32	1.08	0.57	...
13288	...	Horseshoe Mt., Colo	♀	1.75	0.67	0.22	0.01	0.15	0.23	0.50	0.23	0.20	0.30	1.19	0.67	...
...	...	Montgomery, Colo	...	...	...	...	...	...	...	...	...	...	...	1.85	0.70	...
...	...	do	...	...	...	...	...	...	...	...	...	...	...	1.07	0.61	...
...	...	do	...	...	...	...	...	...	...	...	...	...	...	1.13	0.67	...
...	...	do	...	...	...	...	...	...	...	...	...	...	...	1.08	0.70	...
...	...	do	...	...	...	...	...	...	...	...	...	...	...	1.12	0.67	...
...	...	do	...	...	...	...	...	...	...	...	...	...	...	1.25	0.66	...
...	...	do	...	...	...	...	...	...	...	...	...	...	...	1.07	0.58	...
...	...	do	...	...	...	...	...	...	...	...	...	...	...	1.09	0.68	...
...	...	do	...	...	...	...	...	...	...	...	...	...	...	1.17	0.63	...

TABLE III.—List of specimens of LAGOMYS PRINCEPS.\*

Catalogue-number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
9573	.....	789	♂	Montgomery, Park County, Colo.	July 30, 1871	Rocky Mountain Expedition.	J. A. Allen and C. W. Bennett.	Skin.
9574	.....	859	♂	do	do	do	do	do.
9575	.....	861	♂	do	do	do	do	do.
9576	.....	862	♂	do	do	do	do	do.
9577	.....	864	♂	do	do	do	do	do.
9578	.....	865	♂	do	do	do	do	do.
9579	.....	866	♂	do	do	do	do	do.
9580	.....	867	♂	do	do	do	do	do.
9581	.....	868	♂	do	do	do	do	do.
9582	.....	869	♂	do	do	do	do	do.
9583	.....	870	♂	do	do	do	do	do.
9584	.....	871	♂	do	do	do	do	do.
9585	.....	872	♂	do	do	do	do	do.
9586	.....	873	♂	do	do	do	do	do.
9587	.....	874	♂	do	do	do	do	do.
9588	.....	875	♂	do	do	do	do	do.
9589	.....	876	♂	do	do	do	do	do.
9590	.....	877	♂	do	do	do	do	do.
9591	.....	878	♂	do	do	do	do	do.
9592	.....	879	♂	do	do	do	do	do.
9593	.....	880	♂	do	do	do	do	do.
9594	.....	881	♂	do	do	do	do	do.
9595	.....	882	♂	do	do	do	do	do.
9596	.....	883	♂	do	do	do	do	do.
9597	.....	884	♂	do	do	do	do	do.
9598	.....	885	♂	do	do	do	do	do.
9599	.....	886	♂	do	do	do	do	do.
9600	.....	887	♂	do	do	do	do	do.
9601	.....	888	♂	do	do	do	do	do.
9602	.....	889	♂	do	do	do	do	do.
9603	.....	890	♂	do	do	do	do	do.
9604	.....	891	♂	do	do	do	do	do.
9605	.....	892	♂	do	do	do	do	do.
9606	.....	893	♂	do	do	do	do	do.
9607	.....	894	♂	do	do	do	do	do.
9608	.....	895	♂	do	do	do	do	do.
9609	.....	896	♂	do	do	do	do	do.
9610	.....	897	♂	do	do	do	do	do.
9611	.....	898	♂	do	do	do	do	do.
9612	.....	899	♂	do	do	do	do	do.
9613	.....	900	♂	do	do	do	do	do.
9614	.....	901	♂	do	do	do	do	do.
9615	.....	902	♂	do	do	do	do	do.
9616	.....	903	♂	do	do	do	do	do.
9617	.....	904	♂	do	do	do	do	do.
9618	.....	905	♂	do	do	do	do	do.
9619	.....	906	♂	do	do	do	do	do.
9620	.....	907	♂	do	do	do	do	do.
9621	.....	908	♂	do	do	do	do	do.
9622	.....	909	♂	do	do	do	do	do.
9623	.....	910	♂	do	do	do	do	do.
9624	.....	911	♂	do	do	do	do	do.
9625	.....	912	♂	do	do	do	do	do.
9626	.....	913	♂	do	do	do	do	do.
9627	.....	914	♂	do	do	do	do	do.
9628	.....	915	♂	do	do	do	do	do.
9629	.....	916	♂	do	do	do	do	do.
9630	.....	917	♂	do	do	do	do	do.
9631	.....	918	♂	do	do	do	do	do.
9632	.....	919	♂	do	do	do	do	do.
9633	.....	920	♂	do	do	do	do	do.
9634	.....	921	♂	do	do	do	do	do.
9635	.....	922	♂	do	do	do	do	do.
9636	.....	923	♂	do	do	do	do	do.
9637	.....	924	♂	do	do	do	do	do.
9638	.....	925	♂	do	do	do	do	do.
9639	.....	926	♂	do	do	do	do	do.
9640	.....	927	♂	do	do	do	do	do.
9641	.....	928	♂	do	do	do	do	do.
9642	.....	929	♂	do	do	do	do	do.
9643	.....	930	♂	do	do	do	do	do.
9644	.....	931	♂	do	do	do	do	do.
9645	.....	932	♂	do	do	do	do	do.
9646	.....	933	♂	do	do	do	do	do.
9647	.....	934	♂	do	do	do	do	do.
9648	.....	935	♂	do	do	do	do	do.
9649	.....	936	♂	do	do	do	do	do.
9650	.....	937	♂	do	do	do	do	do.
9651	.....	938	♂	do	do	do	do	do.
9652	.....	939	♂	do	do	do	do	do.
9653	.....	940	♂	do	do	do	do	do.
9654	.....	941	♂	do	do	do	do	do.
9655	.....	942	♂	do	do	do	do	do.
9656	.....	943	♂	do	do	do	do	do.
9657	.....	944	♂	do	do	do	do	do.
9658	.....	945	♂	do	do	do	do	do.
9659	.....	946	♂	do	do	do	do	do.
9660	.....	947	♂	do	do	do	do	do.
9661	.....	948	♂	do	do	do	do	do.
9662	.....	949	♂	do	do	do	do	do.
9663	.....	950	♂	do	do	do	do	do.
9664	.....	951	♂	do	do	do	do	do.
9665	.....	952	♂	do	do	do	do	do.
9666	.....	953	♂	do	do	do	do	do.
9667	.....	954	♂	do	do	do	do	do.
9668	.....	955	♂	do	do	do	do	do.
9669	.....	956	♂	do	do	do	do	do.
9670	.....	957	♂	do	do	do	do	do.
9671	.....	958	♂	do	do	do	do	do.
9672	.....	959	♂	do	do	do	do	do.
9673	.....	960	♂	do	do	do	do	do.
9674	.....	961	♂	do	do	do	do	do.
9675	.....	962	♂	do	do	do	do	do.
9676	.....	963	♂	do	do	do	do	do.
9677	.....	964	♂	do	do	do	do	do.
9678	.....	965	♂	do	do	do	do	do.
9679	.....	966	♂	do	do	do	do	do.
9680	.....	967	♂	do	do	do	do	do.
9681	.....	968	♂	do	do	do	do	do.
9682	.....	969	♂	do	do	do	do	do.
9683	.....	970	♂	do	do	do	do	do.
9684	.....	971	♂	do	do	do	do	do.
9685	.....	972	♂	do	do	do	do	do.
9686	.....	973	♂	do	do	do	do	do.
9687	.....	974	♂	do	do	do	do	do.
9688	.....	975	♂	do	do	do	do	do.
9689	.....	976	♂	do	do	do	do	do.
9690	.....	977	♂	do	do	do	do	do.
9691	.....	978	♂	do	do	do	do	do.
9692	.....	979	♂	do	do	do	do	do.
9693	.....	980	♂	do	do	do	do	do.
9694	.....	981	♂	do	do	do	do	do.
9695	.....	982	♂	do	do	do	do	do.
9696	.....	983	♂	do	do	do	do	do.
9697	.....	984	♂	do	do	do	do	do.
9698	.....	985	♂	do	do	do	do	do.
9699	.....	986	♂	do	do	do	do	do.
9700	.....	987	♂	do	do	do	do	do.
9701	.....	988	♂	do	do	do	do	do.
9702	.....	989	♂	do	do	do	do	do.
9703	.....	990	♂	do	do	do	do	do.
9704	.....	991	♂	do	do	do	do	do.
9705	.....	992	♂	do	do	do	do	do.
9706	.....	993	♂	do	do	do	do	do.
9707	.....	994	♂	do	do	do	do	do.
9708	.....	995	♂	do	do	do	do	do.
9709	.....	996	♂	do	do	do	do	do.
9710	.....	997	♂	do	do	do	do	do.
9711	.....	998	♂	do	do	do	do	do.
9712	.....	999	♂	do	do	do	do	do.
9713	.....	1000	♂	do	do	do	do	do.
9714	.....	1001	♂	do	do	do	do	do.
9715	.....	1002	♂	do	do	do	do	do.
9716	.....	1003	♂	do	do	do	do	do.
9717	.....	1004	♂	do	do	do	do	do.
9718	.....	1005	♂	do	do	do	do	do.
9719	.....	1006	♂	do	do	do	do	do.
9720	.....	1007	♂	do	do	do	do	do.
9721	.....	1008	♂	do	do	do	do	do.
9722	.....	1009	♂	do	do	do	do	do.
9723	.....	1010	♂	do	do	do	do	do.
9724	.....	1011	♂	do	do	do	do	do.
9725	.....	1012	♂	do	do	do	do	do.
9726	.....	1013	♂	do	do	do	do	do.
9727	.....	1014	♂	do	do	do	do	do.
9728	.....	1015	♂	do	do	do	do	do.
9729	.....	1016	♂	do	do	do	do	do.
9730	.....	1017	♂	do	do	do	do	do.
9731	.....	1018	♂	do	do	do	do	do.
9732	.....	1019	♂	do	do	do	do	do.
9733	.....	1020	♂	do	do	do	do	do.
9734	.....	1021	♂	do	do	do	do	do.
9735	.....	1022	♂	do	do	do	do	do.
9736	.....	1023	♂	do	do	do	do	do.
9737	.....	1024	♂	do	do	do	do	do.
9738	.....	1025	♂	do	do	do	do	do.
9739	.....	1026	♂	do	do	do	do	do.
9740	.....	1027	♂	do	do	do	do	do.
9741	.....	1028	♂	do	do	do	do	do.
9742	.....	1029	♂	do	do	do	do	do.
9743	.....	1030	♂	do	do	do	do	do.
9744	.....	1031	♂	do	do	do	do	do.
9745	.....	1032	♂	do	do	do	do	do.
9746	.....	1033	♂	do	do	do	do	do.
9747	.....	1034	♂	do	do	do	do	do.
9748	.....	1035	♂	do	do	do	do	do.
9749	.....	1036	♂	do	do	do	do	do.
9750	.....	1037	♂	do	do	do	do	do.
9751	.....	1038	♂	do	do	do	do	do.
9752	.....	1039	♂	do	do	do	do	do.
9753	.....	1040	♂	do	do	do	do	do.
9754	.....	1041	♂	do	do	do	do	do.
9755	.....	1042	♂	do	do	do	do	do.



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MONOGRAPHS  
OF  
NORTH AMERICAN RODENTIA.

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No. V.—CASTOROIDIDÆ.

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By J. A. ALLEN.

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[ For letter of transmittal, see p. 401. ]



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## FAMILY CASTOROIDIDÆ.

### GENUS CASTOROIDES Foster.

*Castoroides* FOSTER, Second Rep. Geol. of Ohio, 1838, 61.—WYMAN, Boston Journ. Nat. Hist., v, 1846, 401.

The skull, in general outline, considerably resembles that of *Castor*, but the cranial portion is relatively very much smaller and more flattened, and the facial portion much longer than in that genus. The zygomatic processes arise at a much higher point, and the zygomatic arch is much less curved downward. The malar bone is narrower, relatively far less massive, and is less prolonged anteriorly, not reaching the front wall of the orbit. In *Castor*, on the contrary, it reaches the small lachrymal, by which only it is separated from the anteorbital process of the frontal. The narrowest portion of the skull is behind the middle instead of anterior to it, as in *Castor*. The basilar cavity seen in *Castor* is entirely wanting, and the auditory bullæ are smaller. "The tympanic portions of the temporal bones present very nearly the same conformation as in the *Capybaras*; at the inner extremity, however, there exists a broad plate or process having a concavity forward, which enters into the formation of the posterior limit of the pterygoid fossa. . . . In the development and conformation of the pterygoid processes, the *Castoroides* differs from all existing Rodentia. Both processes articulate with the tympanic bone, but the development of the external plate is by far the greatest; the internal, however, has the remarkable peculiarity of being curved inwards towards the median line, so that the most prominent part of its convex surface is brought in contact with that of the corresponding process of the opposite side. In consequence of this, the entrance to the posterior nares, or the meso-ptyergoid fossa, is completely obstructed in its middle portion, and instead of one large quadrangular orifice, as in other Rodentia, we have two distinct orifices; one of these, superior, of a pyriform shape, the circumference of which is formed in part by the posterior extremities of the pterygoid processes, and in part by the anterior basilar portion of

the occipital bone; the second, inferior, is formed by the origins of the same processes and the posterior edges of the ossa palati.

"The pterygoid fossa has a depth of about two inches, which, added to the great breadth of the outer process and the curvature of the inner, gives an extraordinary surface for the origin of the internal pterygoid muscle. The fossa serving for the origin of the external pterygoid muscle, involves the whole of the greater wing of the os sphenoides, and is more remarkably developed than in any of the allied genera."\*

The molars differ strikingly in structure not only from those of *Castor*, but from those of all other Rodents except the *Chinchillidæ*, a near resemblance being met with elsewhere only in the last molar of *Hydrochaerus*. They consist of a series of laminæ of dentine completely inclosed by enamel, held together by a thin coating of cement. The circumference of the triturating surface of the tooth is thus devoid of the continuous plate of enamel that forms an uninterrupted border in the molar teeth of ordinary Rodents, and is deeply serrated. The dentinal laminæ, with their inclosing plate of enamel, are three in number in all the molars except the last upper and first lower, which have each four. When the teeth are exposed to disintegrating influences, the laminæ of dentine and enamel readily fall apart, as is the case in the molars of the *Chinchillidæ*, in the last molar of *Hydrochaerus*, and in the molars of the Elephant. In structure, the molar teeth of *Castoroides* are strictly comparable with those of the *Chinchillidæ*, and with the posterior portion of the last molar of *Hydrochaerus*, and thereby differ not only radically from that seen in *Castor*, but from that of all other Rodents. The structure is precisely that seen in *Lagostomus*, even to the oblique position of the laminæ, except that the number of the laminæ in *Castoroides* is one more to each tooth (two more in the first lower molar) than in *Lagostomus*. The dentinal laminæ are very similar also to the dentinal laminæ of the last molar of *Hydrochaerus*, but they are relatively much thicker. The molar teeth of *Castoroides* are thus compound, and have no resemblance to those of *Castor*, with which genus *Castoroides* is usually compared.

In other features of the skull, strong resemblances can be traced between *Castoroides* and *Lagostomus*, especially in respect to the form of the pterygoid processes and the size and form of the pterygoid fossæ.† The general form

\* Wyman, Bost. Journ. Nat. Hist., vol. v, pp. 394, 395.

† In these features, however, *Fiber* much more nearly approaches *Castoroides* than does *Lagostomus*.

of the skull also somewhat resembles that of *Lagostomus*, but differs in important details. *Castoroides*, for instance, lacks the large antorbital vacuity seen in *Lagostomus* and its allies; this portion of the skull more resembling that of *Castor*. The lower jaw also much more resembles that of *Castor*, but differs from that of the latter in having the coronoid process much less strongly developed; in the much greater elongation of the condylar process; in the great depth of the fossa on the outer surface below the notch formed by the coronoid and condylar processes (which is shallow in *Castor*); in the lateral flattening of the condyles; in the bending inward of the angular process and its much greater development, as well as in the much greater depth of the fossa on the inner border of the lower surface of the angle. The inward curvature of the angular process is also an exceptional feature among Rodents. *Castoroides* further differs from *Castor* in the form of the occipital condyles, which are more terminal and less oblique than in *Castor*, and, while permitting a great range of vertical motion of the head, allow only a slight lateral motion.

From the foregoing remarks, it will be seen that *Castoroides* presents a singular combination of characters, allying it, on the one hand, to the Beaver, and, on the other, to the Chinchillas and Viscachas, and also to the Muskrat, but which, at the same time, separate it widely from either group. In size, *Castoroides* exceeded any living Rodents, and is itself exceeded in this order by only a single extinct form of *Hydrochærus*, described by Dr. Lund from the bone-caverns of Brazil. The resemblance of *Castoroides* to *Castor* is mainly in the general outline of the skull, in its having an imperforate ante-orbital wall, and in its presenting a similar curvature of the descending ramus of the lower jaw, the latter a character shared also by *Fiber*. The differences consist in the remarkable structure of the pterygoid processes, the double orifice of the posterior nares being entirely exceptional; in the flattened and relatively small cranium; and in the compound nature of the molar teeth. These differences ally it, on the other hand, to the Chinchillas, from which it differs mainly through those points in which it resembles *Castor*. In view of these wide differences from its nearest well-known allies, it seems to constitute the type of a distinct and hitherto unrecognized family. To the same group are, however, probably referable the genera *Amblyrhiza* and *Loxomy-lus*, described by Professor Cope,\* from the bone-caverns of Anguilla Island,

\* Proc. Acad. Nat. Sci. Phila., 1868, 313; Proc. Amer. Phil. Soc., vol. xi (1869-70), pp. 153, 606, pls. iv, v.

West Indies. These forms are thus far known only from the detached teeth and fragments of the bones of the limbs. The molars, as described and figured by Professor Cope, greatly resemble those of *Castoroides*, having, in fact, the same structure, differing mainly in being somewhat smaller, and in possessing a greater number of laminae. The incisors are also much smaller and narrower, and much less strongly grooved. Professor Cope states that some of the molars of *Amblyrhiza* have four dentinal columns and others five, while those of *Loxomylus*, including both upper and lower, have only three each. The characters of *Amblyrhiza*, as Professor Cope recognizes, ally it to the Chinchillas, while he says of *Loxomylus* that the obliquity of "the horizontal grinding surface . . . alone seems to distinguish it from *Lagidium* and *Chinchilla*". As the lower jaw and skull are thus far unknown in these genera, it is impossible to say whether their affinities are strictly with the *Chinchillidae*, or whether they are not more closely allied to *Castoroides*. The same may be said of *Archæomys*, a European form commonly referred to the *Chinchillidae*.\* Hence the question naturally arises whether the *Chinchillidae* have not been found outside of South America. The discovery of a single mandibular ramus, or the facial portion of the skull from each of these genera, would at once decide the question of their affinities, which cannot well be settled without the evidence such parts would afford. In either case, these genera furnish a type of dentition unknown in the present fauna, except in South America.

Although *Castoroides* has generally been supposed to have the relationship to *Castor* its name implies, and in systematic works has been always associated with the Beavers, Dr. Wyman, in his monographic account of the Clyde skull, points out the great differences that exist between the two types. He says the cranium "presents analogies to the genera *Castor*, *Fiber*, and *Hydrochaeris*. Osteologically considered, the cranium bears a stronger resemblance in its shape to that of the Castors than to that of either of the other genera; but in its dentition the type is wholly different, as is also the conformation of the pterygoid processes and fossæ. . . . . In the *Hydrochaeris*, the principal analogies are found in the compound nature of the molar teeth.†

\* Mr. Alston (Proc. Zool. Soc. Lond., 1876, p. 86) refers *Archæomys* to the family *Theridomysidae*, with the other forms of which, however, it does not seem to me to be very closely related.

† From the absence of all reference by Dr. Wyman to the much closer resemblance of the teeth of *Castoroides* to those of the Chinchillas, he was evidently not at that time acquainted with the osteology of that group.

... In the Fibers, the pterygoid fossæ are largely developed, but the entrance to the posterior nares has the same conformation as in the other Rodents.\* It is almost surprising, in view of Dr. Wyman's admirable memoir and excellent figures, that zoölogists have so long overlooked the important characters that distinguish *Castoroides* from all other Rodents.†

## CASTOROIDES OHIOENSIS Foster.

## SYNONYMY.‡

- [*Extinct animals of the order Rodentia FOSTER*], Amer. Journ. Sci. and Arts, xxxi, 1837, 80, figs. 15-17 (first description of the Nashport specimens). Published anonymously.
- Castoroides ohioensis* FOSTER, Second Rep. Geol. of Ohio, 1838, 81, and fig. (Nashport specimens).—WYMAN, Proc. Bost. Soc., ii, 1846, 138 (Clyde specimens).—HALL, Proc. Bost. Soc. Nat. Hist., ii, 1846, 167 (Clyde specimens; geological position).—HALL and WYMAN, Boston Journ. Nat. Hist., v, 1847, 385, pls. xxxvii-xxxix (Clyde specimens; geological position and description of a skull).—WHITTLESBY, Am. Journ. Sci. & Arts, 2d ser., v, 1848, 215 (geological position of the Nashport specimens).—WYMAN, *ibid.*, x, 1850, 62, fig. 5 (lower jaw; Memphis specimen).—WYMAN, Proc. Bost. Soc., iii, 1850, 281 (same).—AGASSIZ, Proc. Amer. Assoc. Adv. Sci., v, 1851, 179 (Nashport specimens).—LECONTE, Proc. Acad. Nat. Sci. Phila., vi, 1852, 362 (Shawneetown specimens).—BRONN, Leth. Geog., 1857, 1046, pl. lix, fig. 8.—PICTET, *Traité de Paléont.*, i, 1853, 353.—BAIRD, Mam. N. Amer., 1857, 362.—LEIDY, Holmes's Post-pliocene Fossils S. Car., 1860, 114; Proc. Acad. Nat. Sci. Phila., 1867, 97; Journ. Acad. Nat. Sci. Phila., 2d ser., v, 1869, 405 (skull from Coles County, Illinois).—WINCHELL, Amer. Nat., iv, 1870, 504 (Michigan).
- Castor (Trogotherium?) ohioensis* DEKAY, Nat. Hist. N. York, Zool., i, 1842, 89.

## DESCRIPTION AND HISTORY.

The so-called "Fossil Beaver" of North America was of about the size of a full-grown common Black Bear (*Ursus americanus*), hence somewhat exceeding in size the Capybara, the largest of existing Rodents.

\* Boston Journ. Nat. Hist., vol. v, p. 399.

† Even Mr. E. B. Alston, in his recent paper on "The Classification of the Order Glires" (Proc. Zool. Soc. Lond., 1876, p. 79), places *Castoroides* in the family *Castoridae*.

‡ The following are the titles of, or references to, some of the special papers treating of *Castoroides*:

- 1837—[FOSTER (J. W.). Extinct Animal of the Order Rodentia.] < Amer. Journ. Sci. and Arts, xxxi, 1837, 80, figs. 15-17.
- 1838—FOSTER (J. W.). [Description of *Castoroides Ohioensis*.] < Second Rep. Geol. of Ohio, 1838, 80-83, fig. 140.
- 1846—WYMAN (J.). [On *Castoroides Ohioensis*.] Proc. Bost. Soc. Nat. Hist., ii, pp. 138, 139.
- 1846—HALL (J.). [On Geological Relations of the Fossil *Castoroides Ohioensis*.] < Proc. Bost. Soc. Nat. Hist., ii, p. 167, 168.
- 1847—HALL (J.) and WYMAN (J.). Notice of the Geological Position of the Cranium of the *Castoroides Ohioensis*. By James Hall, esq. ... Also an Anatomical Description of the same. By Jeffries Wyman. < Bost. Journ. Nat. Hist., vol. v, art. xxix, pp. 385-401, pl. 37-39.
- 1850—WYMAN (J.). [On a Lower Jaw of *Castoroides Ohioensis*.] < Proc. Bost. Soc. Nat. Hist., iii, p. 281.
- 1852—LECONTE (J.). [Remarks on a New Locality—Shawneetown—for *Castoroides Ohioensis*.] < Proc. Phila. Acad. Nat. Sci., vi, p. 53.
- 1867—LEIDY (J.). [On a Skull of *Castoroides* found near Charleston, Ill.] < Proc. Phila. Acad. Nat. Sci., 1867, pp. 97, 98.

A cast of a skull (from an unknown locality) now before me has a length of over twelve inches, considerably exceeding in size the Clyde skull described and figured by Dr. Wyman. The species being known only from a few cranial and dental remains, it is impossible to say much respecting its general form or probable habits. It may have been aquatic, like the Beaver; but of this there is no evidence. The form of the occipital condyles and the surfaces for the attachment of the cranial muscles show that it probably differed greatly in habits from the Beaver. Mr. J. W. Foster described (anonymously) a radius found with the two mandibular rami discovered at Nashport, Ohio, which he presumed to belong to the same animal. This bone he describes as being ten inches in length, and as measuring two inches across the head and one and a half across the distal extremity.\* In a later notice of the same specimens, Mr. Foster makes no mention of this bone, and no other naturalist appears to have given any further account of it. Mr. Foster regarded it as "an animal closely allied to the Beaver, but far surpassing him in magnitude". Dr. Wyman not only does not refer to it as a Beaver, but dwells especially upon the important differences that separate it from that animal.

The remains of *Castoroides ohioensis* thus far reported consist of the two right rami of the lower jaw and an upper incisor from Nashport, Licking County, Ohio (from which the animal was originally made known), first described by Foster; the skull and a right ramus of the lower jaw from Clyde, Wayne County, New York, described (and the skull figured) by Wyman; the ramus of a lower jaw from Memphis, Tennessee, also described and figured by Wyman; "two molars, an upper incisor, and two petrous bones", from near Shawneetown, Illinois, and fragments of teeth from the Ashley River, South Carolina, described by Leidy. A skull from near Charleston, Coles County, Illinois, is also mentioned by Leidy. Hall and Wyman both refer to the discovery of its remains near Natchez, Mississippi, and in Louisiana; but I have met with no description of specimens from these localities. Winchell mentions the discovery of its remains in Michigan, of which no description has yet appeared. In the Museum of Comparative Zoölogy, Cambridge, Massachusetts, are portions of several lower incisors and parts of several molar teeth, from Dallas, Dallas County, Texas, collected by Mr. J. Boll, from "alluvial" deposits on the Trinity River, associated with remains of an

\* Amer. Journ. Sci. and Arts, 1st ser., vol. xxxi, 1837, p. 80.



extinct Horse and the Mastodon. There is also in the Museum of Comparative Zoölogy an excellent cast of a very large skull, from an unknown locality, but probably from either Illinois or Michigan.\* Its known habitat hence extended from Texas to Michigan, and thence eastward to Western New York and South Carolina. Its remains appear to have been found only in the Quaternary deposits, and in several instances have been found associated with those of the Mastodon, and also with those of the extinct Horse and Megatherium, with which animals it was doubtless a contemporary.

Of the Clyde specimen (of which I have before me a cast), Dr. Wyman has published the following measurements: Length, 10.50 inches; greatest width, 7.20; transverse diameter of the occiput, 5.50; vertical diameter of the occiput, 2.60; distance between the orbits, 1.90; distance between the anterior (first) molars, 0.30; between the last molars, 1.80. The length of the molar series in the cast is 2.50; length of the nasal bones, 3.63; greatest width of the nasals, 2.07. The cast of a much larger and evidently older specimen, but unfortunately imperfect, lacking the incisors and the zygomatic arches, gives the following measurements: Length, 11.75 (with the incisors restored, 12.50); distance between orbits, 2.83; transverse diameter of the occiput, 6.70; vertical diameter of the same, 3.25; nasals, length, 4.12; greatest width, 2.55; upper molars, length of the series, 2.87. Though so much larger (one-fifth) than the Clyde specimen, the difference is readily accounted for by the difference in age.

According to Foster, the lower jaw found at Nashport measured 9 inches 2 lines (9.16) from the front border to the condylar process, and 3 inches 8 lines (3.67) from the base to the coronoid process. The Clyde example, according to Wyman, had a length of 7.00, and a vertical depth, measured from the top of the coronoid process, of 3.75. The Memphis specimen, according to Wyman, was still larger; the length of the molar series being 3.10, against 2.75 in the Clyde specimen and 2.80 in the Nashport specimen. Foster gives the length of the lower incisor in the Nashport specimen, measured along its outer curve, as 11.50. One of the fragments of a lower incisor from Dallas, Texas, has a transverse diameter of nearly an inch (0.95), while the antero-posterior diameter is still greater (1.05).

\* This cast was taken from a skull loaned by Messrs. Foster and Stimpson to Professor Agassiz some years since, and returned recently to the Chicago Academy of Sciences. No record accompanies the cast, and all the above-named gentlemen being now dead, it is difficult to learn the history of the original specimen.



The anterior face of the incisor teeth is marked with broad, shallow, longitudinal grooves, about twice as wide as the rather abrupt, narrow, intervening ridges. The lower incisor, seen in section, is triangular, with the anterior face rounded. The first upper molar has a width of 0.75 (in the larger specimen), the succeeding ones becoming successively slightly narrower and shorter, except the last, which is the longest. In the lower molars, the first is the longest and the fourth the shortest; the second is the widest. The first three are somewhat narrowed near the middle, giving the triturating surface an hour-glass form.

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MONOGRAPHS  
OF  
NORTH AMERICAN RODENTIA.

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No. VI.—CASTORIDÆ

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By J. A. ALLEN.

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[ For letter of transmittal, see p. 401. ]



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## FAMILY CASTORIDÆ.

Taking *Castor*, which is the only well-known form, as the type of the family, the *Castoridae* present many points of resemblance to the *Sciuridae*, of which group the *Castoridae* were formerly regarded as constituting a sub-family. Both *Castor* and *Haplodon* (= *Aplodontia* Richardson) are evidently quite nearly allied to the *Sciuridae*, and, together with *Anomalurus* and the extinct North American *Ischyromys*, are properly placed by Alston in his *Sciuromorphic* series, each being regarded as the type of a distinct family.

*Castor* differs from any of the Squirrels in being adapted to an aquatic mode of life, and presumably several, but probably not all, of the extinct genera\* commonly referred to the *Castoridae* were similarly modified. While the skull in all the genera referred to the Beaver group presents in general form some similarity to that of the Squirrels, it constantly differs in many important particulars. It not only lacks the strongly-developed post-orbital processes seen in all the genera of the *Sciuridae*, but the molar series are not widely separated, and converge anteriorly instead of being parallel, and the palatal area of the intermaxillaries is arched instead of plane. In the *Sciuridae*, the molars are truly rooted, with multiple fangs, short crowns, and a tuberculated triturating surface, and undergo much change as a result of attrition. In *Castor*, the molars have a long-persistent dentinal pulp, the teeth continuing to grow for a long period, and becoming truly rooted only late in life; they are single-rooted, have no well-defined coronal portion, and the triturating surface consists of a complicated infolding of the enamel-border of the tooth, and undergoes little change by attrition; they decrease in size posteriorly. The lower jaw is more massive, and the rami are more firmly united by a much longer symphyseal surface. The incisors are of very large

\* *Trogotherium* (Owen), *Eucastor*, *Palaeocastor*, *Stenofiber*, *Chalicomys*, and *Castoroides*.

size, and the general structure of the skull indicates great incisive power, the Beavers being "gnawers" *par excellence*.

The living representatives of the family *Castoridae* belong to the single genus *Castor*. Beaver-like animals, belonging to five or six other genera, have, however, been referred to the same group. Some of these (*Steneofiber*, including *Palaeocastor* Leidy and *Chalicomys*) differ widely from *Castor*, while one (*Castoroides*) is more nearly related to the Chinchillas (*Lagostomus*) than to any other family of Rodents. Others (*Trogontherium* and *Eucastor*) evidently are closely related to *Castor*. The extinct genera, above named, are as yet known from too scanty materials to render certain their true affinities. *Trogontherium*, whose remains occur sparingly in the Tertiary deposits of Europe, evidently greatly resembled *Castor*; it was, however, fully one-fifth larger, and in its dentition differs generically from *Castor*. The genus *Eucastor*, known as yet from very imperfect cranial remains found in the Mauvaises Terres of Dakota, of the size of a Marmot (*Arctomys*), seems to have been a true Beaver, apparently as closely related to *Trogontherium* as to *Castor*. *Chalicomys* and *Steneofiber* differ considerably both in dentition, and in the general form of the skull, from the true Beavers, and may prove, when better known, to pertain to an entirely different group. *Chalicomys* has thus far been found only in the Tertiary formations of Europe, while *Steneofiber* had representatives not only in Europe, but in the Tertiary formations of New Mexico and Dakota.

The genus *Castoroides*, heretofore always referred to the *Castoridae*, has, as already shown,\* only a superficial resemblance to the true Beavers.

#### GENUS CASTOR Linn.

*Castor* LINN., Syst. Nat., i, 1766, 178.

CHARS.—Feet four-toed; hind feet palmate, with the second toe double-clawed. Tail broad, flat, and scaly. Body stout and heavy, most strongly developed posteriorly. Grinding-teeth  $\frac{1}{2}$ , single-rooted, with the dentinal pulp persisting to a late period of life. General form of the skull as in the *Sciuridae*, but lacking the postorbital processes, and otherwise differing.

Represented by only a single living species (*Castor fiber*), whose habitat formerly embraced the greater part of the northern hemisphere. Remains of *Castor* have been described from the Tertiary deposits of Europe, which

\* See the preceding Monograph.

seem scarcely distinct from the existing species (*C. fiber*), whose remains also occur in the Tertiary and Quaternary deposits of Europe and in the Quaternary deposits of North America. The existing Beaver is separable into two well-marked subspecies, one of which is restricted to North America, and the other to Europe and Western Asia.

## CASTOR FIBER Linn.

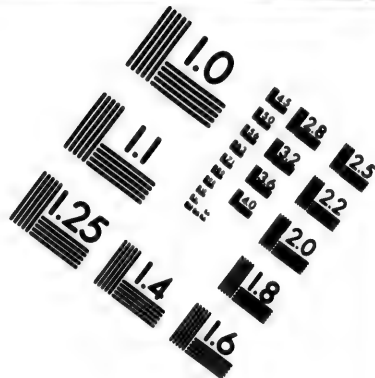
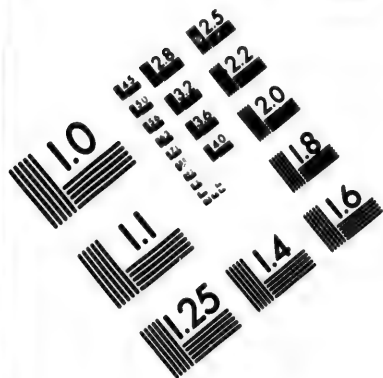
Beaver.

## SYNONYMY.\*

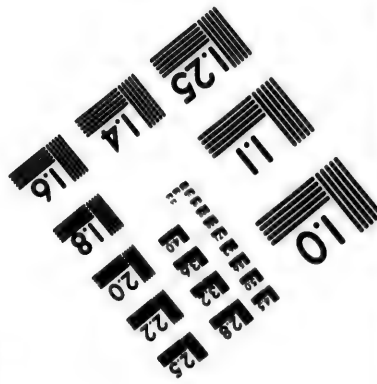
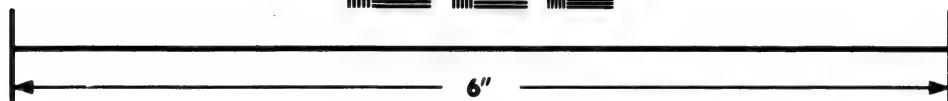
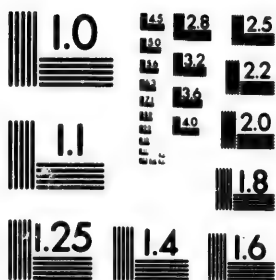
- Castor fiber* LINN., Syst. Nat., ed. 12th, i, 1766, 78.—FORSTER, Phil. Trans., lxi, 1772, 375.—ERHLEBEN, Syst. Reg. Anim., 1777, 440.—GMELIN, Syst. Nat., i, 1788, 124.—SCHREBER, Säuget., iv, 1792, 623, pl. cixvi (skull), pl. cixv (animal).—SHAW, Gen. Zool., ii, 1803, 30.—TIEDEMANN, Zool., i, 1808, 481.—PALLAS, Zoographia Rosso-Asiatica, 1811, 412.—OKEN, Naturgesch., iii, 2, 1816, 879.—CUVIER, Règne Anim., i, 1817, 186.—DESMAREST, Mamm., 1822, 277.—KNOX, Mem. Wern. Nat. Hist. Soc., iv, 1823, 548 (anatomy).—J. SABINE, Franklin's Journ. to the Polar Sea, 1823, 669.—SAY, Long's Exped. R. Mts., i, 1823, 464.—HARLAN, Fauna Amer., 1825, 122.—GODMAN, Am. Nat. Hist., ii, 1828, 21.—GRIFFITH's Cuvier's An. King., v, 1827, 207.—BRANDT & RATZBURG, Medis. Zool., i, 1829, 13, pl. iii, iv, v a.—OWEN, Proc. Zool. Soc. Lond., 1830, 19 (anatomy).—BENNETT, Gardens and Menag. Zool. Soc. Quad., i, 1835, 153.—DOUGHTY, Cal. Nat. Hist., iii, 1839, 598, pl. i.—WATERHOUSE, Charlesworth's Mag. Nat. Hist., iii, 1839, 606 (figure of skull).—SCHINZ, Europ. Faun., 1840, 57.—KEYSERLING & BLASIUS, Wirbelt. Europ., 1840, 31.—EMMONS, Quad. Mass., 1840, 51.—THOMPSON, Hist. Vermont, 1842, 38.—DEKAY, Nat. Hist. N. York, i, 1842, 72, pl. xx, fig. 1, pl. viii, figs. a, b.—NILSSON, Skand. Faun., 1847, 409.—WOODHOUSE, Sitgreaves's Exped. down the Zuni and Col. Riv., 1853, 47 (New Mexico).—GIEBEL, Säuget., 1855, 619.—BLASIUS, Naturgesch. Säuget. Deutschl., 1857, 405.—WILSON, Edinb. New Phil. Journ., 3d ser., viii, 1858, 1 (fossil; Scotland; and geog. distr.).—THEIRIOT, Verhandl. Ver. f. Naturk. v. Presburg, 1860-61, 21.—HOLZ, ib., 96.—ZEITLIS, ib., 16.—SMITH, Proc. Acad. Nat. Sci. Phila., 1861, 146 (habits Amer. Beav.).—FITZINGER, Zool. Gart., 1864, 373 (habits Europ. Beav.).—REEKS, Zoologist, 2d ser., 1869, 1953 (Newfoundland).—COPE, Proc. Acad. Nat. Sci. Phila., 1869, 173 (fossil; Virginia).—ALLEN, Bull. Mus. Comp. Zool., i, 1869, 226; Proc. Bost. Soc. Nat. Hist., xiii, 1869, 190; xvii, 1874, 43; Bull. Essex Institute, vi, 1874, 49, 56, 61, 65.—LILLJEBORG, Fauna Sveriges och Norges, 1871, 346.
- Castor canadensis* KÜHL, Beitr. z. Zoologie, 1830, 64.—FISCHER, Synop. Mamm., 1829, 238.—NEWBERRY, Pacif. R. R. Expl. and Surv., vi, iv, 1867, 62 (California and Oregon).—BAIRD, Mamm. N. Amer., 1858, 355, pl. xlviii, fig. 1 (skull); U. S. and Mex. Bound. Surv., ii, ii, 1859, 40.—COOPER, Pacif. R. R. Expl. and Surv., xii, ii, 1859, 82 (California, Oregon, and Washington Territory); Amer. Nat., ii, 1868, 533 (Upper Missouri).—SUCKLEY, Pacif. R. R. Expl. and Surv., xii, 1869, ii, 100 (Milk River).—LEIDY, Holmes's Post-pliocene Fossils South Carolina, 1860, iii, pl. xxi, fig. 2 (fossil; Ashley River, S. C.); Journ. Phil. Acad. Nat. Sci., 2d ser., v, 1869, 403 (fossil).—HAYDEN, Trans. Amer. Phil. Soc., xii, 1862, 146 (Upper Missouri).—COUES, Amer. Nat., i, 1867, 362; Proc. Acad. Nat. Sci. Phila., 1867, 135 (Arizona).—GILPIN, Proc. and Trans. Nova Scotia Inst. Nat. Sci., iii, 1872, 152 (Beaver dams).—GREEN & BROWN, Journ. Linn. Soc. Zool., x, 1899, 361 (nat. hist. and hunting; Pacific slope of Rocky Mts.).
- Castor fiber* var. *americanus* RICHARDSON, Faun. Bor.-Amer., i, 1829, 105.—WAGNER, Suppl. Schreber's Säuget., iv, 1844, 7.—AUDUBON & BACHMAN, North Am. Quad., i, 1849, 347, pl. xlv.—WYMAN, Am. Journ. Sci. and Arts., 2d ser., x, 1850, 61, fig. 4 (fossil; Memphis, Tenn.).—MORGAN & ELY, The Beaver and his Works, 1868, 44, pl. i-xxiii, and 26 woodcuts (general history and anatomy).
- Castor (fiber var. ?) canadensis* COUES & YARROW, Wheeler's Expl. and Surveys west 100th Merid., v, Zool., 1876, 123 (Colorado, Utah, and Arizona).

\* Many references additional to those here given to early papers on the general history and anatomy of the Beaver may be found in Brandt and Ratzburg's elaborate memoir on this animal (Medizinische Zoologie, 4to, Berlin, i, 1829, pp. 12-30), which is particularly rich in references to pre-Linnæan works. Dr. Coues (see Bibliographical appendix to this article) has also kindly added other references to the American Beaver.





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*Castor americanus* RICHARDSON, Back's Arctic Land Exped., 1836, 404.—BRANDT, Mém. Acad. St. Pétersb., 6th ser., Sci. Nat., vii, 1855, 64, pls. i, ii, iii (tail and skull).—MAXIMILLIAN, Wiegmann Arch., 1862, i, 132.

*Castor europæus* OWEN, Brit. For. Mam., 1846, 190.

*Castor fiber seu europæus* BRANDT, Mém. Acad. St. Pétersb., 6th ser., Sci. Nat., vii, 1855, 63.

*Castor fiber* var. *europæus* MORGAN, Amer. Beaver and his Works, 1868, 44.

*Le Castor ou le Biber*, BRISSON, Règne, Anim., 1756, 133.

*Castor Beaver*, PENNANT, "Synop. Quad., 255; Hist. Quad., 1781, No. 351"; Arctic Zool., 2d ed., i, 1793, 113, *The Beaver*, LAWSON, Hist. Carolina, 1871, 191.—CATESBY, Nat. Hist. Carolina, 1731, i, xxix.—BRICKELL,

Nat. Hist. N. Car., 1737, 151.—HEARNE, Journ. to the Northern Ocean, 1795, 236.—HICK-

WELDER, Trans. Amer. Phil. Soc. 1st ser., vi, 1909, 309 (habits).—BUCKLEY, Amer. Journ.

Sci. and Arts, 2d ser., iii, 1846, 434 (North Carolina).—BRUMLEY, *ibid.*, iv, 1847, 285 (Ala-

bama).—A. AGASSIZ, Proc. Bost. Soc. Nat. Hist., xiii, 1860, 100 (Beaver dams).—BAUSOT, Ann.

Rep. Smith. Inst. for 1873, 1874, 422 (habits).

*Le Castor du Canada*, F. CUVIER & GEOFFROY, Hist. Nat. des Mam., i, liv. 6, 1819 (figure).

*Castor d'Europe*, F. CUVIER & GEOFFROY, *ibid.*, iii, liv. 51, Oct. 1825 (figure).

#### DESCRIPTION.

Body thick, heavy, depressed, enlarging posteriorly, broadest near the hips; head large and broad; muffle naked; nostrils lateral, divided; ears short, rounded, furred, and nearly hidden in the pelage; tail broad and flat, covered with horny blackish scales; fore feet short and weak, unwebbed; hind feet large, fully palmate; soles of all the feet naked, upper surface hairy; second toe of hind feet usually furnished with a double claw, the supplemental one being placed transversely beneath the true one; under-fur soft, dense, and grayish; overlying hairs coarse, shining-chestnut. Length of body, about 30 inches; of tail, about 10; weight of adult, about 45 to 50 pounds, ranging to upward of 60.

The general color of the Beaver above is reddish-brown, varying to lighter or darker in different individuals and probably with the season; lighter, approaching grayish, below. The Beaver appears to be generally darker to the northward, where it is occasionally nearly black. Albinistic individuals are also more or less frequent, either wholly white, creamy white, or with patches of white. To such specimens have been given the various varietal names of *nigra*, *albus*, *variegatus*, *flavus*, etc.

The Beaver is apparently several years in attaining its growth, increasing in size long after it has acquired its mature dentition. Two-year-old Beavers generally weigh about thirty-five to forty pounds, while very old ones occasionally attain a weight of upward of sixty. Morgan records the capture of one which weighed sixty-three pounds. The increase in the size of the skull seems to continue nearly through life; in old age the skull not only acquires larger dimensions, but the weight is relatively greater in conse-

quence of the increased thickness and density of the bones. The ridges for the attachment of muscles also become more strongly developed in old age. All of the forty-five skulls, of which measurements are given below, had attained mature dentition, but the variation in size they present with age is very considerable. In the series of sixteen from Arctic America, the variation in length ranges from 4.45 to 5.25, and in breadth from 3.15 to 3.85. In a series of twelve skulls from the Platte and Upper Missouri Rivers, the variation is still greater, ranging in length from 4.40 to 5.65, and from 3.10 to 4.15 in breadth. The apparent wide range of individual variation in size in the large series of skulls examined is largely due to differences of age, as will be seen from an examination of the subjoined table of measurements, in which the relative age of the specimens is indicated, as judged by the condition of the sutures, the teeth, the relative development of the ridges for muscular attachment, and the density of the bony structure. In four very old skulls from nearly the same locality, the greatest variation is from 5.10 to 5.25 in length, and 3.50 to 3.85 in breadth. In the three marked in the table as "old", but evidently younger than those marked "very old", the variation ranges from 4.50 to 4.90 in length, and from 3.30 to 3.60 in breadth. Those evidently much younger, and marked in the table as "middle-aged", eight in number, all fall within these extremes, so that the range of purely individual variation may amount to fully 20 per cent. of the average. In respect to particular elements of the skull, the variation is greater than in general size. Nos. 9477 and 7201, with a length of 5.25 each, vary in breadth from 3.50 to 3.85. Yet the narrower of these two skulls has much the wider nasals, which have a breadth of 0.95 against 0.87 in the other; they are, however, at the same time shorter, having a length of only 1.72 against 1.90 in the other, and hence vary enormously in general form, in the one being short and greatly expanded, in the other long, narrow, and of nearly uniform width throughout. In the one, the zygomatic arch is short, broad, and heavy; in the other, narrower, longer, and more slender. The interparietal bone in these two skulls is as different in shape as can well be imagined. In No. 7201, the anterior half is triangular, the posterior abruptly expanding, and basally greatly widening. In No. 8676, it is more than one-half smaller, and is regularly triangular to its base. In other skulls, it is even still narrower; this element of the skull presenting, in different specimens, almost endless variations in respect to both size and form. The frontals are perhaps still more variable, especially in respect to the interparietal portion. This portion

is more than twice as wide in some specimens as in others of the same size; the parietal borders are sometimes straight and parallel, but sometimes straight and at the same time rapidly convergent; but generally their parietal border is more or less concave. Their interorbital breadth is also very variable. The lachrymal varies greatly in size, and, while generally triangular, is occasionally quadrate. The anterior nasal aperture, while narrower below than above, is generally distinctly quadrate, but sometimes decidedly triangular, and often more or less approaches a triangular form. It also varies exceedingly in relative size. The nasals vary greatly, as already shown, in size and form, independently of the general size of the skull, ranging in length from 1.72 to 1.90, and in breadth from 0.87 to 1.00. Posteriorly, they may be truncate, pointed, or bifurcate. Generally, the greatest width is anterior to the middle, the anterior half being abruptly expanded at the middle, or the lateral outline may be regularly and moderately swollen. Marked variations are also noticeable in respect to the size and form of the zygomatic processes; in the relative size of the malar bone; and in the general details of the lower surface of the skull.

In regard to geographical variation in size, the largest specimens are from the Upper Missouri. Of the twenty-six skulls marked in the table as "old" or "very old", six Alaskan ones average 4.91 by 3.61; nine Upper Missouri and Platte River skulls average 5.30 by 3.89; three Lake Superior and Maine skulls average 4.95 by 3.47; four Rio Grande and Mississippi skulls average 5.23 by 3.88. Of the "middle-aged" series, nine from Arctic America average 4.84 by 3.39; five from the Upper Missouri, 4.54 by 3.32; a middle-aged Mississippi skull measures 4.70 by 3.35. While the specimens are too few to yield positive results, it seems safe to assume that the Upper Missouri animal is larger than either the Alaskan or Texan one, and that even the Texan one is rather larger than the Arctic American. The southern skulls, however, are evidently much more aged than those from the far north, so that more specimens, all equally aged, would probably show little, if any, difference in size between those from the extreme north and the extreme south. While the series of "old" skulls from the Upper Missouri country averages much larger than the series from the far north, the average for the middle-aged series is reversed, the northern being the larger. This difference, however, is more apparent than real; the Upper Missouri series of five marked "middle-aged" averaging considerably younger than the more northern series of nine similarly marked.

## RELATION OF THE AMERICAN AND OLD WORLD BEAVERS.

The earlier, and by far the greater part of naturalists have regarded the Beavers of the Old World and the New as specifically identical. According to Brandt,\* Oken,† in 1816, first suggested that they were different; he regarding the American animal as being more reddish and much the larger. G. Cuvier,‡ in 1817, affirmed, that, after the most scrupulous comparison of the Old World Beaver, from different localities, with the New World Beaver, he was unable to satisfy himself whether or not they were specifically distinct. In 1820, Kuhl§ described a young specimen of the American Beaver from Hudson's Bay, under the name *Castor canadensis*, without, however, giving any special reasons therefor. In 1825, F. Cuvier,|| in describing specimens of the European Beaver, claimed that there were very decided differences in the structure of the skull as well as in size, he stating the European Beaver to be "d'un sixième plus grand qu'un Castor du Canada". His detailed account of the cranial differences, however, show that his American skull was that of a quite immature animal, and that the differences mentioned were mainly such as would result from differences of age. He calls attention, however, to one point of some importance, and one which all subsequent comparisons have confirmed, namely, the greater posterior extension of the nasal bones in the European animal. G. Cuvier,¶ the same year, also dwells upon the importance of the same character as distinctive of the two forms, as well as also upon the general form of the nasal bones. In 1827, Brandt and Ratzeburg\*\* pointed out numerous minor differences in the shape of the head, tail, feet, incisors, etc., as existing between the single individuals compared. Richardson,†† in 1829, called the American Beaver *Castor fiber, americanus*, but cited no differences characterizing the two forms. Keyserling and Blasius‡‡ treated the European Beaver as specifically distinct from the American, and Wagner,§§ in 1844, as variably distinct. Audubon and Bachman,||| in 1846, also formally adopted the same view, but stated that the only difference per-

\*Mém. Acad. St. Pétersb., 6th ser., vol. vii, p. 44.

†Lehrb. d. Zoologie, 2te Abth., p. 380.

‡Édne Anim., 1st ed., tome i, p. 191.

§Beiträge zur Zoologie, p. 64.

||Hist. Nat. des Mam., liv. 51.

¶Ossem. Foss., 3d ed., tome v, p. 57.

\*\*Medizinische Zoologie, vol. i, pp. 13-30.

††Faun. Bor.-Amer., vol. i, p. 106.

‡‡Wirbelthiere des Europæ, p. 7.

§§Abhandl. d. Münchener Akad., math.-phys. Classe, 1844, p. 36; Suppl. Schreiber's Säuget., iv.

|||Quadr. N. Amer., vol. i, p. 347.

ceptible to them was the rather larger size of the American animal. In 1855, Brandt\* made an elaborate study of the subject, arriving at the conclusion that the New and Old World Beavers were specifically distinct, from his finding a few slight but tolerably constant cranial differences, coupled with certain differences in the structure of the castoreum-sacs, and in the properties of the castoreum itself. Baird,† in 1858, supported the same view, without adducing, however, any additional evidence, although inclining to the opinion that the American animal was the larger. In 1868, Morgan and Ely‡ re-examined the subject, having at command a large amount of material, and came to the conclusion that, at best, the two animals could be regarded as only varieties of the same species.

The evident thoroughness with which Brandt investigated the subject has generally led to the adoption of his conclusions, and, consequently, for the last twenty years, the Beavers of the Old and the New World have quite currently passed as distinct though closely related species.

In order to present the subject fairly, I transcribe Brandt's general summary in full, in the words of Dr. Ely's translation, together with Dr. Ely's valuable comments. Brandt's material consisted of eight European and five American skulls, while Dr. Ely's series of American skulls exceeded one hundred, but embraced only a single European one. By the aid of Brandt's excellent monograph, however, he was able to quite satisfactorily compare the two forms. As Dr. Brandt's paper gives a most elaborate and detailed account of the differences observed by him between the crania of the two forms, I quote it somewhat at length, using Dr. Ely's translation in preference to the original, since it thereby becomes more easily available to the majority of American readers. I also append a summary of Dr. Ely's comments, based, as they are, upon the careful investigation of an exceptionally large number of specimens. I furthermore incorporate therewith the results of my own study of an additional series of upward of sixty American skulls and two European ones.

Dr. Brandt finds, through his own studies and those of his predecessors in the same field, that outwardly there are no satisfactory indications of specific difference, either in size, color, the form of the head, ear, or foot, or in the scales of the tail; but that the skull affords a number of pretty constant

\* *Mém. Acad. St. Pétersb.*, 6th ser., *Sci. Nat.*, vol. vii, pp. 43-66.

† *Mam. N. Amer.*, p. 356.

‡ *The Beaver and his Works*, chap. i, and appendix A.

differences, some of which are quite striking; and that the structure of the castor-sacs and the properties of their secretion also differ notably in the two forms. Some of the differences in the structure of the skull pointed out have less value than Dr. Brandt assigned to them, being variations of an inconstant and individual character, while those he relies upon as of more importance Dr. Ely shows are not so constant as Brandt, from the study of his small number of specimens, supposed them to be. There are few, if any, differences mentioned by Brandt as distinctively characterizing the European Beaver that cannot be found occasionally in the American. On this point, Dr. Ely remarks, that, through his large series of American skulls, he finds "that many more resemblances may be traced between the European and the American Beaver than he [Brandt] has observed, thus reducing the amount of constant differences between the two varieties".\*

In respect to the superior aspect of the skull, Brandt says:

"If we examine the skull of the European and of the American Beaver [from above], we notice the following special differences:

"(1) The portion of the frontal bone lying between the arches of the eyebrows, in all the European skulls is shorter and broader, much broader than long; but in the American narrower and somewhat longer (quite as broad as long); so that the middle transverse diameter of the anterior portion of the frontal bone—that part lying between the eyes—is in the American skulls nearly or quite as long as the arch of the eyebrows; but in the European it appears longer than this."

Dr. Ely says this is generally true of the American skulls, but he finds exceptions, in which the interorbital portion of the frontals is broader than long, a statement my own series of American skulls confirms. In six specimens, Dr. Ely found the average breadth to be 0.27 of an inch greater than the length.

"(2) In the European skulls," says Brandt, "the arches of the eyebrows are shorter, and their posterior tubercles, opposite the highest point of the malar bone, are strongly developed. In the American, on the contrary, the posterior eyebrow processes (only indicated, sometimes scarcely indicated at all, or at least but slightly developed) can be seen back of the highest point of the malar. The anterior eyebrow process is in all the European skulls likewise stronger than in the American."

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\* Morgan's "Beaver and his Works", p. 290.



Dr. Ely states that in the older and larger American skulls, both orbital processes are strongly developed, in many skulls the posterior one being as strongly marked as in the European, a statement I find confirmed by my own series. In the American skulls, he finds the position of the postorbital process, in respect to the highest point of the malar bone, to be as stated by Brandt, but records one exception to even this difference.

"(3) The snout," says Brandt, "measured from the inferior orbital opening to the inferior corner of the nostril in two European skulls of equal size (Nos. 56 and 136 of the Kiew Coll.) is broader and somewhat longer than in an American skull in the Academic Museum."

"(4) The nasal bones," Brandt continues, "show the greatest variations. Their length in all the European is much above one-third the length of the skull, measured from the incisor teeth to the crista occipitalis; while, on the contrary, in the three larger of the American skulls the length of the nasal bones is only a little if any over one-third, and the smallest not even one-third the length of the skull. The nasal bones of the six older skulls lying before me of the European Beaver are therefore longer, and extend more or less far posteriorly, *i. e.* more or less beyond the anterior prominence of the arch of the eyebrows, so that they (the nasal bones) lie with their posterior borders nearly or quite opposite the middle of the margin of the orbits. In a young Polish Beaver (No. 57 of the Kiew Coll.) they reach, however, only to the anterior third of the orbital ring, and in our young Lapland Beaver they lie nearly as in our California Beaver skull, opposite only the circumference of the anterior border of the orbital ring. In none of five American skulls, lying before me, on the contrary, do the nasal bones extend beyond the anterior prominence of the eyebrows. In nearly all the skulls of the European Beaver, compared with the five American ones lying before me, the nasal bones are in form longer in the middle and posterior, however, in general narrower, so that their breadth in their middle varies between one-fourth and one-fifth of their length, while in our five American skulls the breadth of their middle portion attains to between one-third and one-fourth of their length. Although the nasal bones of the American beaver are thus on the whole broader, still they vary less in this respect than in their lesser length. The external border of the nasal bones of the European Beaver is not so strongly curved as in the American. Two of the European skulls, however, approach quite to the American in this respect. The superior surface of the

anterior half of the nasal bones is in six of the European skulls pretty plane; in two of the others, on the contrary (Nos. 51 and 1955 of the Kiew Coll.), as in all the five American, it is strongly convex. In regard to the character (or relation) of the nasal bones, there remains, therefore, in consequence of the preceding remarks, only their more considerable length in comparison with the skull as a mark of the European Beaver; since the greater lengthening posteriorly of the nasal bones cannot be so rigorously proven in all European Beavers, especially not in our Lapland specimens. It is possible, however, that the nasal bones are less prolonged posteriorly in younger animals than in full-grown, so that in this way the full-grown European might be recognized by its posteriorly prolonged nasal bones. Confirmatory of this view are the following facts: 1. That in all of the six old skulls lying before me of European Beavers, the posterior extremities of the nasal bones reach more or less far posteriorly, and that this happens in a young skull of the Kiew Collection (No. 57), the length of which is four lines greater than that of the one from Lapland; and, 2, that in one very young American skull, the nasal bones extend backward somewhat less relatively than in the full-grown."

As Dr. Ely remarks, it is in respect to the nasal bones that the greatest difference has been observed between the European and American Beavers. This difference was long since pointed out by both the Cuviers, and later confirmed by Owen as well as Brandt. The greater posterior prolongation is not, however, constant, as shown by Brandt himself, and in one of the European skulls now before me, a *very old* instead of a young specimen (No. 3672, "Skagit River"), they do not extend beyond the point reached by one-fifth of the American skulls now before me. In none of the American skulls, however, do they attain the posterior extension ordinarily seen in the European. In sixty American skulls, the nasals terminate posteriorly, in one-fifth of them, about opposite the middle of the anterior orbital process; in nearly one-half, they terminate opposite the hinder margin of the anterior orbital process; in eight others, they advance a little more posteriorly; and, in twelve others, pass slightly beyond this point, exactly corresponding in this respect with frequent specimens of the European Beaver. In one American specimen, the nasals do not quite reach the point opposite this process. In respect to their relative length, as compared with the whole length of the skull, the American average rather shorter than the European, ranging, in the American skulls, from 0.34 to 0.36 of the length of the skull against 0.38 in two Euro-

pean skulls. Dr. Ely states that, in six American skulls, the average length is 5.39, and the average length of the nasals 1.81, or nearly 0.34 of the length. In three others, with an average length of 4.42, the nasals average 1.59 or 0.36 of the length. In seven others, he finds, however, the relative length of the nasals still greater.

"(5) The frontal portion of the lachrymal bone in the American Beaver," Brandt finds, "is more triangular,—posteriorly twice as broad as anteriorly,—and smaller than in the European; it is also nearly limited to the space between the malar and frontal bones; since it impinges only with its anterior border-like narrow end upon a small process of the upper jaw, or even only approaches it. In the Beavers of the Old World, however, the larger, more quadrangular, anteriorly and posteriorly equally broad frontal portion of the lachrymal bone lies not only between the malar and frontal bones, but is united in similar extent equilaterally with the superior maxillary."

In the majority of instances, Dr. Ely finds the differences here mentioned by Brandt, but states that in some of his skulls the lachrymal has the quadrangular form, being as broad anteriorly as posteriorly, and my own series affords additional exceptions, the individual variation in the form of this bone being very great in the American skulls.

In respect to the anterior aspect of the skull, Dr. Brandt found the nasal opening triangular in the European,—narrower inferiorly, and hence more or less pointed,—but quadrangular in the American, being but little narrower below than above. Dr. Ely notes the greater tendency to the quadrangular form in the American, but cites examples where the opening is nearly if not quite as triangular as in the European, and I find several American skulls in my series that fully bear out the statement. The form of the nasal opening, however, is very variable; in very few is it distinctly quadrangular, being generally considerably narrowed and rounded, or more or less angular, below. Dr. Brandt also finds the inter- and inferior maxillaries broader in the European skulls than in the American, and the incisors also correspondingly broader. As shown by Dr. Ely, however, the difference is evidently somewhat less than the amount claimed by Dr. Brandt.

In respect to the lateral aspect of the skull, Dr. Brandt finds no difference in the dorsal outline in the two forms, but points out a number of alleged differences in other features. The zygomatic process of the maxillary he claims is relatively narrower, as compared with the malar bone, in the

American than in the European; but both Dr. Ely's series and my own furnish many exceptions to this, which seems to be a distinction of little importance.

The differences referred to by Brandt, in respect to the prominence of the nasal process of the intermaxillary, the form of the malar bone, and the presence of a ridge below the orbital ring, formed by the junction of the parietal and frontal bones, are also inconstant, and of slight or very doubtful value as features distinctive of the two forms; and the same may be also almost said of the other differences detailed by Brandt as occurring in the lateral aspect of the skull (numbered 6, 7, and 8 under § 3 in his memoir); the parts referred to are so variable in different specimens of the American animal.

In respect to the posterior aspect of the skull, the main difference insisted upon by Brandt is in respect to the shape of the occipital foramen. Respecting this point, Dr. Ely well observes: "If we examine a large number of skulls of the American Beaver, the great variety of forms presented by the occipital foramen appears remarkable. It is sometimes low and broad, again a rounded arch, and in other instances shows the high triangular shape peculiar to the European variety. This form is found frequently in young, and occasionally in old [American] skulls."

In respect to the posterior aspect of the skull, Dr. Brandt notices the larger size and greater depth of the basilar cavity in the European, with the more rounded margins, and the more anterior position of the auditory bullæ, differences both Dr. Ely's specimens and my own show to be quite constant. In the American skulls, these are quite variable features, so that occasionally there is a close approximation to the European form.

After noticing in detail all of the alleged differences pointed out by Dr. Brandt, Dr. Ely concludes his examination in the following words: "I have thus endeavored to show, from an examination of a large number of skulls of the American Beaver, that a greater tendency to variation in these structures exists than was observed by Dr. Brandt, in the smaller number (five American and eight European), on which he based his differential characteristics. It will be remembered that Brandt does not insist upon the most obvious feature which distinguishes the Old World Beaver from that of the New World, viz. the greater lengthening posteriorly of the nasal bones, since it 'cannot be rigorously proven in all cases'. Following out, then, the principle which guided his researches, many additional exceptional instances have been found

to invalidate the conclusions that the European and the American Beaver constitute different species. The extremes of difference, in their aggregate, on the one side and on the other, are sufficiently striking to justify us in regarding them as varieties of one and the same species; while the want of constancy in these peculiarities suggests the inference, that these variations are due to long separation of the races, and to accidental causes, rather than to original diversity of the stock. It is conceded by the advocates of a diversity of species that the Beavers of the Old and the New World cannot be distinguished by any external characteristic. The same is true of their habits and instincts, except so far as they have been evidently controlled by external influences. The castoreum secretion is variable, even in the European Beavers, and there are facts to show that the elements of the food of the animal are found in it.\* The differences observed in it, being more of degree than of kind, are not of such a character as to render it improbable that they are due to the influence of climate, food, and accidental causes."†

A careful analysis of the above-noted cranial differences between the European and American Beavers shows that they consist mainly in (1) the greater general breadth of the anterior portion of the skull, resulting in a greater interorbital breadth, wider nasal bones, wider muzzle, and consequently wider incisors; (2) the relatively greater posterior extension of the nasals; (3) the greater size and depth of the basilar cavity; and (4) in less marked and rather more inconstant features of difference in a few other points. Conceding with Dr. Ely their varietal or subspecific distinctness, the two forms may be thus conveniently diagnosed:

*Castor fiber* var. *fiber*.—Dorsal surface of the interorbital region generally as broad as, or broader than, long; nasals extending backward beyond the posterior border of the anterior orbital process; basilar cavity deep and large; bullæ placed more anteriorly, etc.

*Castor fiber* var. *canadensis*.—Dorsal surface of the interorbital region generally longer than broad; nasals generally not reaching beyond the middle of the anterior orbital process; basilar cavity comparatively shallow, etc.

*Synonymy and Nomenclature*.—In respect to the distinctive name of the American form, that of *canadensis* of Kuhl evidently has priority; the *améri-*

\* The castoreum of the American Beaver is well known to differ very materially from that of the Old World Beaver, and has a very much smaller commercial value. Chemical analyses show that the castoreum of the Russian Beaver contains more volatile oil, castorin, and resin, and much less carbonate of lime, than that of the American Beaver.

† Morgan's "The Beaver and his Works", p. 399.

*canus* "of Cuvier" being proposed some five years subsequently. Yet by Richardson, Audubon and Bachman, Brandt, Morgan and Ely, and others, the later name has been adopted in preference to the earlier one of Kuhl. For the Old World Beaver, the original Linnæan name *fiber* has been by some rejected for the later one, *europæus*, used by Owen.

## GEOGRAPHICAL DISTRIBUTION.

The Beaver family existed in North America as far south along the Atlantic seaboard as Georgia and Northern Florida.† It also occurred throughout the Gulf States nearly as far south as the Gulf coast, and in Texas to the Rio Grande. Its exact limit south of the Rio Grande I have not been able to determine; but that its range extended for some distance into Mexico is well ascertained. The collection of the National Museum contains specimens from Franklin County, Mississippi, the Lower Rio Grande, and Santa Clara, California, and Dr. Coues‡ gives it as an inhabitant of Arizona. It is abundant in Alaska, and in the interior extends to the Barren Grounds; its northern limit being apparently coincident with the northern limit of forests. Its present range, however, is much less extended, very few being found east of the Mississippi River south of the Great Lakes, and it is far less numerous everywhere than formerly. Some still remain in Northern Maine and in the Adirondack region of New York, and probably some still survive thence southward in the sparsely-settled districts to Alabama and Mississippi. A recent article in "Forest and Stream" (vol. vi, No. 13, p. 197, Nov. 2, 1876) states that they are still abundant in portions of Virginia.§ Their former

\* The name *Castor americanus* is universally attributed to F. Cuvier, but I am unable to find it anywhere used in his writings. In his "Hist. Nat. des Mammifères", he uses the common name only,—"Le Castor du Canada"—yet this work is usually cited as the origin of the specific name "*americanus*" as applied to the American Beaver.

† Bartram, Travels, p. 281.

‡ Proc. Acad. Nat. Sci. Philad., 1867, p. 135; Am. Nat. p. 509.

§ The above-cited article mentions particularly Dinwiddie, Nottoway, Brunswick, Cumberland, and Greenville Counties, where it says beaver-trapping has of late been again profitably pursued. "For instance," says this account, "there is the veteran trap-maker, Mr. Newhouse, who made his headquarters in Greenville County last winter; he realized some \$900 by his expedition, besides selling several hundred dollars' worth of steel traps. And two of our subscribers from Connecticut, and others from Central New York, went down to Brunswick and Nottoway, and when they had harvested their packs of pelts and were ready to leave, taught the native young 'chincopins' and negroes to set traps, so that they, too, might add to their scanty earnings. More than one small farmer has had occasion to bless the strangers who came among them and showed them how to catch fur. . . . Besides putting money into their own purse, the trapper in Virginia will do the residents a great service by killing of the 'vermin' that destroy their crops, and thereby save as well as earn. We have ourselves seen acres of corn totally destroyed by the Beavers down there, and we know that the havoc they make with the grain causes a serious loss to needy and struggling people." This advertisement of the abundance of the Beavers in Virginia will doubtless result in their rapid numerical decrease, if not speedy total extirpation, through excessive persecution, unless the authorities of Virginia should have the wisdom to interpose legal protection for the otherwise doomed animals.

existence in great abundance throughout the Atlantic States, and thence westward to the Pacific, is thoroughly attested. They having been less persistently hunted during recent years than formerly, they are reported to be slowly on the increase at most localities where they still remain.

Dr. Coues informs me that he has seldom failed to find Beaver on the various streams of the west he has explored, from the British to the Mexican boundary. In some of the more secluded waters, where the animals have been little hunted, he has watched them disporting in broad daylight with little sense of danger. He has nowhere found them more abundant than on the various mountain-streams which unite to form the heads of the North Platte River, in North Park, Colorado, where some of the rivulets are choked for miles with successive dams.

The Berlandier MSS. attest the presence of the animal in various portions of Mexico.

#### FOSSIL REMAINS.

Fossil remains of the American Beaver have been discovered in New York and New Jersey, at Memphis, Tennessee, associated with the remains of *Castoroides*,\* in the Post-pliocene deposits of the Ashley River, South Carolina, and in the bone-caverns of Pennsylvania and Virginia. The bones of the European Beaver have been found also in deposits of Post-pliocene age, and even in those of the Tertiary. Owen† reports the occurrence of the remains of the European Beaver with those of the *Trogontherium*, *Megaceros*, and *Mastodon*, under circumstances indicative of their contemporaneous existence, carrying the antiquity of the European Beaver "far back into the Tertiary period". In the Val d'Arno, according to the same authority, they have been found associated with the remains of the Mammoth, Hippopotamus, and Hyæna. They have also been found in Europe in bone-caves, but most commonly occur in peat bogs and other superficial deposits. Some of these remains indicate an animal rather larger than the largest specimens of the existing Beaver. The *Castor issiodorensis* from Issoire is closely related to, if not identical with, *Castor fiber*.

\* Wyman, Amer. Journ. Sci. and Arts, 2d ser., vol. x, 1850, p. 64.

† Brit. Foss. Mam. and Birds, p. 192.



TABLE I.—Measurements of forty-three skulls of CASTOR FIBER CANADENSIS.

Catalogue number.	Original number.	Locality.	Sex.	Total length.*	Greatest width.	Distance between orbits.	Nasal bones, length.	Nasal bones, greatest width.	Upper incisors from front to molars.	Upper incisors from front to hinder margin of palate.	Upper molars, length taken together.	Lower jaw, length.	Lower jaw, height.	Remarks.
8114	1004	Alaska.....	..	4.50	3.50	0.90	1.50	0.90	1.85	3.00	0.95	3.85	1.70	Old.
7370	1117	.....do.....	..	4.70	3.45	0.90	1.75	0.87	3.10	3.10	1.00	3.94	1.15	.....do.
9470	.....	.....do.....	..	5.35	3.70	0.87	1.90	0.87	3.05	3.83	1.06	.....	3.35	Very old.
8675	.....	.....do.....	..	5.90	3.85	0.90	1.97	1.00	3.18	3.48	1.15	3.05	3.30	.....do.
8673	.....	.....do.....	..	5.10	3.75	0.90	.....	.....	3.15	3.35	1.10	4.05	2.40	.....do.
8676	.....	.....do.....	..	4.90	3.60	0.88	1.75	0.90	1.97	3.07	.....	4.90	3.37	Old.
8680	.....	.....do.....	..	4.90	3.35	0.87	1.90	0.88	3.05	3.15	.....	4.10	.....	Middle-aged.
8717	.....	.....do.....	..	4.45	3.15	0.85	1.50	0.80	1.77	3.05	1.00	3.85	2.90	Rather young.
8683	.....	.....do.....	..	4.00	3.00	0.94	1.70	0.87	3.05	3.90	1.07	.....	.....	Middle-aged.
7194	.....	Ft. Good Hope, E. B. T.	♂	4.75	3.35	0.85	1.65	0.89	3.05	3.90	1.03	3.25	3.15	.....do.
7301	.....	.....do.....	..	5.85	3.50	0.95	1.78	0.95	3.15	3.49	1.10	3.85	3.15	Very old.
7304	.....	.....do.....	..	4.75	3.35	0.90	1.73	0.85	3.00	3.10	1.10	3.80	3.05	Middle-aged.
7195	.....	.....do.....	♀	4.85	3.75	0.85	1.70	0.85	3.15	3.25	0.97	3.68	3.10	.....do.
4876	170	Fort Simpson, E. B. T.	.....	4.67	3.35	0.87	1.65	0.80	3.15	3.15	.....	3.67	3.15	.....do.
4804	367	.....do.....	.....	4.85	3.18	0.90	1.88	0.78	1.90	3.00	1.00	3.55	1.90	.....do.
3380	.....	Nelson River, E. B. T.	.....	4.60	3.45	0.87	1.60	0.90	1.95	3.05	0.98	3.80	3.08	.....do.
7389	.....	Lake Superior	.....	5.05	3.50	0.70	1.78	0.85	3.30	3.35	.....	4.00	2.95	Old.
7399	.....	.....do.....	.....	4.85	3.45	0.94	1.70	0.90	3.18	3.25	1.00	3.75	3.23	.....do.
7390	.....	.....do.....	.....	4.50	3.25	0.88	1.40	0.78	1.88	3.23	0.97	3.55	3.05	Middle-aged.
706	.....	Oxford County, Me.	.....	4.95	3.47	0.90	.....	.....	3.17	3.45	1.04	3.80	3.23	Old; nasals broken.
8146	.....	Upper Missouri.....	♀	5.65	4.15	1.12	2.05	1.10	3.60	3.78	1.80	4.65	3.75	Very old.
7384	.....	.....do.....	.....	5.60	4.00	1.06	2.10	1.08	3.53	3.83	1.88	4.65	3.63	.....do.
3977	.....	.....do.....	.....	5.35	4.03	1.00	2.00	1.00	3.40	3.58	1.83	4.40	3.47	.....do.
8830	.....	.....do.....	.....	5.40	3.07	0.95	1.97	1.03	3.35	3.73	1.15	4.45	3.45	.....do.
7385	.....	.....do.....	.....	5.19	3.00	0.95	1.85	0.90	3.40	3.50	1.10	4.30	3.40	Old.
10005	.....	.....do.....	.....	4.90	3.65	0.95	1.85	1.00	3.50	3.35	.....	3.93	3.40	.....do.
893	.....	.....do.....	.....	5.10	3.75	0.94	1.73	0.98	3.30	3.60	1.10	4.10	3.48	.....do.
3460	.....	Platte River.....	.....	5.45	3.75	1.00	1.90	0.95	3.27	3.75	.....	4.90	3.33	Very old.
3478	.....	.....do.....	.....	5.15	3.63	1.00	1.85	0.98	3.15	3.50	1.15	3.95	3.40	.....do.
8286	.....	Upper Missouri.....	.....	4.60	3.45	0.87	1.60	0.85	3.10	3.00	1.00	3.80	3.15	Middle-aged.
3477	.....	Platte River.....	.....	4.40	3.10	0.95	1.47	0.80	1.90	3.00	0.98	3.65	3.10	Middle-aged, or rather young.
8143	.....	Cheyenne River.....	.....	4.50	3.25	0.85	1.51	0.87	1.85	3.00	1.00	3.68	3.17	.....do.
8144	.....	White River, Dak.	.....	4.37	3.37	0.90	1.60	0.85	3.00	3.10	1.00	3.73	3.15	Rather young.
3371	.....	Kansas.....	.....	4.75	3.48	0.95	1.80	0.96	3.00	3.25	1.00	4.67	3.38	Middle-aged; "weight, 35 lbs."
418	.....	Fort Hays, Kans.	.....	5.50	3.85	1.04	1.95	1.03	3.44	3.65	1.10	.....	3.25	Old.
8011	2	Vancouver Island ..	.....	5.20	3.75	0.96	1.90	0.98	3.10	3.45	.....	4.35	3.30	.....do.
10297	.....	Oregon.....	.....	4.98	3.75	0.88	1.75	0.98	3.10	3.30	1.00	3.70	3.15	Middle-aged.
9531	.....	Santa Clara, Cal.	.....	5.00	3.30	0.90	1.65	0.85	3.00	3.30	1.07	4.08	3.28	.....do.
3770	.....	Franklin County, Miss.	.....	5.30	3.65	1.00	1.97	0.90	3.30	3.45	1.12	4.80	3.46	Very old.
19237	.....	Mississippi.....	.....	4.70	3.35	0.98	1.75	0.85	3.15	3.17	1.05	3.90	3.20	Middle-aged.
1003	.....	Rio Grande, Tex.	.....	5.35	3.80	0.85	1.90	0.97	3.35	3.65	1.15	4.82	3.05	Very old.
1416	.....	Matamoros, Mexico ..	.....	5.15	3.60	1.00	1.75	0.97	3.25	3.65	1.20	4.15	3.45	.....do.
1414	.....	.....do.....	.....	5.35	3.65	1.12	1.75	0.98	3.25	3.55	1.20	.....	.....	.....do.
3878	.....	Sagitt River.....	.....	5.50	.....	1.07	2.05	1.00	3.50	3.75	1.20	4.15	.....	Very old; variety fiber.
6864	.....	River Nibe, Germany	.....	5.00	3.30	1.00	2.01	0.90	3.00	3.00	1.10	3.90	3.05	Rather young; variety fiber.

\* From the occipital condyles to front border of the intermaxillaries.



TABLE II.—List of specimens examined of *CASTOR FIBER* var. *CANADENSIS*.

Catalogue number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
8675	8675			Alaska		Dr. T. T. Minor	Dr. T. T. Minor	Skull.
8673	8673			do		do	do	do
8663	8663			do		do	do	do
8670	8670			do		do	do	do
8660	8660			do		do	do	do
8677	8677			do		do	do	do
8669	8669			do		do	do	do
8661	8661			do		do	do	do
8678	8678			do		do	do	do
		1664		do		W. H. Dall	W. H. Dall	do
9479	9479			Kenai, Alaska		F. Blachoff	F. Blachoff	do
6537	7597	1117		Yukon	June 2, —	R. Kennicott	R. Kennicott	Skull and skin.
3019	3281		♂	Nelson River, H. B. T.		D. Gunn	D. Gunn	do
3899	3899			do		do	do	Skull
3378	3378		♂	do		do	do	do
4494	367			Fort Simpson		B. R. Ross	B. R. Ross	do
4892	170	♂		do		do	do	do
4307				do		do	do	do
4429				do		do	do	Skin.
5657				do		do	do	do
4350				Abbitibbe Lake	May 18, 1890	C. Drexler	C. Drexler	do
4356				Moose River, H. B. T.	May 21, 1890	do	do	do
	7804			Fort Good Hope		G. P. Gaudet	G. P. Gaudet	Skull.
	7194	♂		do		do	do	do
	7061			do		do	do	do
	7195	♂		do		do	do	do
	6323			Fort Anderson		R. McFarlane	R. McFarlane	do
	9146	♀		Cheyenne, Wyo		Dr. F. V. Hayden	Dr. F. V. Hayden	do
	9077			Upper Missouri		do	do	do
	9380			do		do	do	do
	7324			do		do	do	do
	881			do		do	do	do
	7885			do		do	do	do
1550				do		do	do	Skin.
9785				do		do	do	do
9786	11330	♂		Fort Bridger		do	H. D. Schmidt	Skull and skin.
1901	9269	♂		Medicine Bow Creek	Aug. 16, —	Lieut. F. J. Bryan	W. S. Wood	do
	3478			Platte River		Dr. F. V. Hayden	Dr. F. V. Hayden	Skull.
	3480			do		do	do	do
	3477			do		do	do	do
	3483	♂		do		do	do	do
	9144	♂		White River, Nebr.		do	do	do
	9143			Cheyenne River, Nebr.		do	do	do
	11632			Wyoming		do	H. D. Schmidt	do
	12397			Oregon		G. P. Bissell	G. P. Bissell	do
	4806			Pitt River, Cal.		J. Follner	J. Follner	do
	3914	♂		San Francisco, Cal.		Captain Rogers	W. Stimpson	do
	3934			Puget Sound		do	do	do
	3935			Vancouver Island		do	J. L. Frost	Lower jaw.
	6011			do		do	do	Skull.
1196				Chehalis Prairie, Wash.		Dr. G. Suckley	Dr. G. Suckley	Skin.
3896				California		Captain Rogers	W. F. Trowbridge	do
	9831			Santa Clara, Cal.		Dr. J. G. Cooper	do	Skull.

\* Two years old.

TABLE II.—List of specimens examined of CASTOR FIBER var. CANADENSIS—Continued.

Catalogue-number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
3371	*418			Kansas .....	Oct. 2, —	Dr. F. V. Hayden	Dr. F. V. Hayden	Skull.
9286			♂	Fort Hays, Kans. ....		Rocky Mt. Exped.	J. A. Allen	do.
9287			♀	Fort Cobb, Ind. Ter. ....		Dr. E. Palmer	Dr. E. Palmer	Skin.
				do .....		do	do	do.
6315				Denver, Colo. ....				Skull.
1648				Fort Chadbourne, Tex. ....		Dr. E. Swift	Dr. E. Swift	Skin.
1414				Matamoros, Mex. ....		Lieut. D. N. Couch	Dr. L. Berlandier	Skull.
1416				do .....		do	do	do.
1003			♂	Rio Grande, Tex. ....		Maj. W. H. Emory	J. H. Clark	do.
3772				Franklin County, Miss. ....		B. L. C. Wallis	B. L. C. Wallis	do.
19037				Mississippi .....		Mr. Keenan	Mr. Keenan	do.
*706				Oxford County, Me. ....		J. G. Rich	J. G. Rich	do.
(*)				do .....		do	do	Skin.
(*)				do .....		do	do	do.
*1358			♂	Magalloway River, Me. ....		J. G. Rich	J. G. Rich	do.
*1360			♀	do .....		do	do	do.
(*) 134				Yellowstone River, N. T. ....		H. A. Wood	H. A. Wood	Skeleton.
1072				Saint Lawrence Co., N. Y. ....		Dr. Hoogh	Dr. Hoogh	Skull.
7362				Lake Superior .....		L. H. Morgan	L. H. Morgan	do.
7363				do .....		do	do	do.
7364				do .....		do	do	do.
7365				do .....		do	do	do.
7366				do .....		do	do	do.
7367				Skagit River .....		do	do	do.
6564				River Elbe, Germany .....		Prince Maximilian.		do.

\* In the Museum of Comparative Zoology, Cambridge, Mass.

\* Variety fiber.

## GENUS EUCASTOR Leidy.

## EUCASTOR TORTUS Leidy.

*Castor (Eucastor) tortus* LEIDY, Proc. Acad. Nat. Sci. Phila., 1858, 31.*Castor tortus* LEIDY, Journ. Acad. Nat. Sci. Phil., 2d ser., v, 1860, 341, 406, pl. xxvi, figs. 21, 22; U. S. Geol. Surv. of Wyoming, 1871, 363.

This species was first described by Dr. Leidy in 1858, from remains discovered by Dr. Hayden in the loose sands of the Niobrara River. These remains consist of the greater portion of an upper jaw, containing portions of the incisors and the three anterior molars on each side, and were redescribed and figured by him in 1869. This fragment indicates an animal smaller even than the common Marmot (*Arctomys monax*), and hence of much less than half the bulk of the existing Beaver. The portion of the jaw described by Dr. Leidy "consists of the under parts of both maxillary and intermaxillary bones, which together are the diminished counterpart in form of the corresponding parts of the recent Beaver. The incisor teeth likewise have the

same relative proportions and form as in the latter animal." The molar teeth, however, differ very much in structure from those of *Castor*, more resembling in some respects those of *Trogontherium*. In *Castor*, the loops of enamel are all open externally; while, in *Eucastor*, they are closed loops, such as are seen in a transverse section of the tooth of *Castor*.\* In *Castor*, the molars decrease very gradually in size posteriorly; the first being but little wider, though considerably longer than the second, the third slightly smaller in both diameters than the second, and the fourth still smaller. In *Trogontherium*, the first three molars, in form and relative size, greatly resemble those of *Eucastor*, and, in the pattern of the grinding surface, there is a closer resemblance than there is to the same teeth in *Castor*; but, in *Trogontherium*, the third molar, according to Owen, is smaller than the fourth. In *Eucastor*, the first molar is equal in length to the length of both the second and third, and proportionately wider. It has three closed loops of enamel; the anterior and posterior loops being each rather less than one-half the size of the middle one, which, instead of being transverse, is placed somewhat obliquely. The second and third teeth have each but two, the anterior of which is, in each tooth, about twice the size of the posterior one. The teeth are also set more obliquely in the jaw, and the first molar has a deep infolding of enamel near the middle of the inner margin of the tooth, directed obliquely forward. In all these features, there is a closer resemblance to *Trogontherium* than to *Castor*.

The specimen described by Dr. Leidy belonged to a "quite aged individual", and to this fact he deemed were possibly due the differences in the structure of the molars seen in this form as compared with *Castor*, as he had not at the time an opportunity of comparing his specimen with equally aged examples of the common Beaver. A large series of the skulls of the American Beaver now before me, embracing those of all ages, show that the permanent molars differ very little in form, or in the pattern of the triturating surfaces, with age. A transverse section of the tooth of *Castor*, however, displays much the same structure as is seen in *Eucastor*.

As shown by the above-cited references, Dr. Leidy at first referred this form to a new subgenus of *Castor*, but later cites it simply as *Castor tortus*. The differences in dentition between *Castor* and *Eucastor* are, however, as great as between *Castor* and *Trogontherium*. Doubtless, other correspond-

\* See Owen's Odontography, plate cvi, fig. 2.

ingly well-marked differences will be found in other features of the skull when we are able to study this interesting form from more nearly perfect specimens.

The following table, showing the comparative measurements of *Eucastor tortus* with the corresponding portion of the skull of *Castor fiber*, is from Dr. Leidy's memoir on the "Extinct Mammalia of Dakota and Nebraska" (Journ. Acad. Nat. Sci. Phila., 2d ser., vol. v, p. 342).

	<i>C. tortus.</i> Lines.	<i>C. fiber.</i> Lines.
Length of space occupied by four molars .....	6½	13
Length of hiatus from first molar to incisors .....	12½	21
Breadth of face opposite first molars .....	7	14
Breadth of face in advance of infra-orbital foramen .....	5½	11
Width of palate between first molars .....	1	3½
Width of palate between last molar alveoli .....	4	7
Antero-posterior diameter of first molar .....	2	3
Transverse diameter of first molar .....	2½	3½
Antero-posterior diameter of second molar .....	1½	3
Transverse diameter of second molar .....	2	3½
Antero-posterior diameter of third molar .....	1½	3
Transverse diameter of third molar .....	2	3½
Diameter of incisors .....	2	3½

### GENUS STENEOFIBER E. Geoffr.

"*Stenocfiber* E. GEOFFROY, Revue Encyclop., 1833, —."

*Palaeocastor* LEIDY, Journ. Acad. Nat. Sci. Phila., 2d ser., v, 1860, 338.

### STENEOFIBER NEBRASCENSIS Leidy.

*Stenocfiber nebrascensis* LEIDY, Proc. Acad. Nat. Sci. Phila., 1856, 80; 1857, 89.

*Chalicomys nebrascensis* LEIDY, Proc. Acad. Nat. Sci. Phila., 1857, 176.

*Palaeocastor nebrascensis* LEIDY, Journ. Acad. Nat. Sci. Phila., 2d ser., v, 1860, 338, 403, pl. xxvi, figs. 7-11;  
U. S. Geol. Survey of Wyoming, 1871, 303.

The present species was first described by Dr. Leidy, in 1856, from specimens collected by Dr. Hayden from the Mauvaisaises Terres of the White River, Dakota. These specimens indicate an animal of about the size of *Eucastor tortus*. The species is thus far known from "a much mutilated skull, with the fragments retained nearly in their original position by a mass of included calcareous matrix. The greater part of the cranium is destroyed, as is also the nose and parts of the jaws, though all the teeth are preserved. A second specimen consists of portions of both jaws of an aged individual, badly mutilated and imbedded in a mass of matrix. The remaining specimens, from a third individual, consist of portions of both sides of the lower jaw and one side of the upper jaw, containing all the molar teeth, and freed from investing matrix."

This species, so far as these specimens indicate its character, appears to resemble the genus *Steneofiber*, from the lower Pliocene formation of Saint-Gérard-le-Puy, France, both in the general form of the skull and in its dentition. So great is this resemblance that Dr. Leidy at first referred it to that genus, which Kaup has regarded as identical with *Chalicomys*. The lower jaw in *Steneofiber*, says Leidy, is unknown, and adds that that of *Palæocastor* is quite unlike the lower jaw in *Chalicomys*. The structure of the molars in *Chalicomys* differs greatly, as shown by Gervais's figures,\* from that of *Steneofiber*, and Geoffroy, Gervais, and others regard the two forms as generically distinct. In *Palæocastor*, the structure of the molars is very similar to what is seen in the figures of the molars of *Steneofiber*. In respect to the skull, Leidy also observes that the "forehead presents the same triangular form and proportionate size" as in *Steneofiber*. "The temporal fosse", he continues, "appear to have had the same form and proportional capacity. They were separated in the same manner by a long sagittal crest, extending forward upon the frontal bone. The cranium, just back of the forehead, was equally constricted. The external auditory passage formed a short, oblique canal, with its orifice directed outward and backward in the same manner. The palatal region, likewise, had the same form and construction, and the infra-orbital foramen held the same relative position as in *Steneofiber viciacensis*. The incisors in both jaws are proportionately as long and strong as in the Beaver, and they have the same form." Dr. Leidy adds that they also strongly approach in form those of the Beaver.

The molar teeth in "*Palæocastor*" differ very greatly in structure from those of either *Castor*, *Eucastor*, or *Trogonthierium*, more resembling, apparently, as do also those of *Steneofiber viciacensis*, those of some members of the *Dasyproctidae*. The skull also differs greatly in form from that seen in these genera in consequence of the much greater constriction above of the interorbital region. Hence "*Palæocastor*", if really belonging to the family *Castoridae*, probably differed very much in general structure from the existing Beavers, and has its nearest ally in the genus *Steneofiber*† of the Miocene epoch of Europe.

\* Zool. et paléont. franç., plates I, viii, and xlviii.

† Gervais says, "Les genres *Chalicomys*, Kaup, et *Steneofiber*, E. Geoff., sont évidemment de la même tribu que les *Castors*" (Zool. et paléont. franç., p. 20), to which group they have been generally referred by subsequent writers. Mr. E. R. Alston, however, in his recent memoir "On the Classification of the Order *Glirice*" (P. Z. S., 1876, pp. 61-92), gives both *Chalicomys* of Kaup and *Palæocastor* of Leidy among the "more doubtful fossil genera" of the family *Castoridae*, as well as the genera *Palæomys* and *Clelodius* of Kaup, and the genus *Trogonthierium* of Fischer (not *Trogonthierium* of Owen, = *Diobroticus*, Pomel).

The measurements given by Dr. Leidy of *Palæocastor nebrascensis* show it to have been of about the size of *Eucastor tortus*, or rather smaller, but somewhat different from it in the relative size of the teeth, in the width of the palate, and in the general form of the skull.

#### STENEOFIBER PANSUS Cope.

*Stenofiber pansus* Cope, Proc. Acad. Nat. Sci. Phila., 1874, 222; Ann. Rep. Wheeler's Expl. west of 100th Merid., 1875, 73.

Of this species, recently described by Professor Cope, from the Santa Fé marls, little is known. It is apparently closely allied to the *S. nebrascensis* of Leidy. Professor Cope's description is as follows: "The molar teeth exhibit a regular gradation in width from the large anterior to the small posterior. In the mandibular series, the second and third are broader than long, the first and fourth longer than broad, and with an angle of the outer anterior side of the crown. There is an inflection or groove of the enamel on both inner and outer sides of the crown, and an enamel area before and one behind them, on all excepting the last molar, where there are two in front. First nearly twice as large as last molar. Lower incisor with smooth enamel, and angulate on the extero-anterior border. Ramus stout. Length of the molar series, 0<sup>m</sup>.016; length of first molar, 0<sup>m</sup>.005; width of first molar, 0<sup>m</sup>.004; width of last molar, 0<sup>m</sup>.0035; transverse diameter of incisor, 0<sup>m</sup>.004; depth of ramus at 2<sup>m</sup>.012.

"The regular diminution of the size of the teeth from front to rear is characteristic of this species; according to Dr. Leidy, their reduction in size in the *S. nebrascensis* is more abrupt. The latter species is said to be of Miocene age."

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 [Oms.—By far the most important publication which has hitherto appeared. See FRIEDL (Friedl), "Ueber den nord-amerikanischen Elber". < Zool. Gart., ix, 1868, pp. 318-320. (Review of the work.)]  
 1874—ANONYMOUS. The Beaver. [From Chamber's Magazine.] < American Sportsman (newspaper) of November 29, 1874.  
 1874—DALL (W. H.). The Beaver. [From Alaska and its Resources.] < American Sportsman of February 7, 1874.  
 1874—BATTY (J. H.). On Beaver. < American Sportsman of October 17, 1874.  
 1874—BRUNOT (F. R.). [On the Habits of *Castor canadensis*.] < Ann. Rep. Smiths. Inst. for 1873, 1874, pp. 422, 423.

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MONOGRAPHS  
OF  
NORTH AMERICAN RODENTIA.

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No. VII.—ZAPODIDÆ.

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By ELLIOTT COUES.

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## LETTER OF TRANSMITTAL.

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OFFICE OF U. S. GEOLOGICAL AND  
GEOGRAPHICAL SURVEY OF THE TERRITORIES,  
*Washington, D. C., November 1, 1876.*

SIR: I transmit herewith a monograph of the family *Zapodidae* for publication as one of the series of articles on the Rodentia of North America, now in course of preparation by Mr. J. A. Allen and myself.

The present article, like others of the series, is based upon the material contained in the National Museum, Smithsonian Institution, including specimens collected by yourself or under your direction. It is republished, with much modification, from the Bulletin of the Survey, second series, No. 5, pp. 253-262.

I am, Sir, &c.,

ELLIOTT COUES,

*Asst. Surg. U. S. A., Secretary of the Survey.*

Prof. F. V. HAYDEN,

*United States Geologist-in-charge.*



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## FAMILY ZAPODIDÆ.

- < Subfamily *Dipodinae*, BAIRD, Mamm. N. Amer. 1857, 428 (*Muridae*).
- = Group *Jaculina*, CARUS, Handb. Zool. 1, 1908, 101.
- = Family *Jaculidae*, GILL, Arrang. Fam. Mamm. 1872, 20.
- = Family *Zapodidae*, COUES, Bull. U. S. Geol. and Geogr. Surv. Terr. 1875, 24 ser. No. 5, 233.
- = Subfamily *Jaculina*, ALSTON, Proc. Zool. Soc. Lond. 1876, 89 (*Dipodidae*).

The single known species which represents this family has been variously classified by different authors. Since the period when it was commonly assigned to the genus *Mus* of the older writers, it has usually, under various generic designations, been considered to be allied to the Jerboas (*Dipus*), doubtless on account of a superficial resemblance it bears to those animals. It has frequently been referred to the genus *Dipus* itself; while, even among the modern authors who have appreciated a generic distinction between *Dipus* proper and *Zapus*, there have been those who regard these two genera as components of one subfamily, *Dipodinae*, of the family *Muridae*. But the two genera have little in common aside from the ordinal characters they share with other Rodents—little of consequence in common beyond the features by which they are both to be recognized as members of the Murine series\* of Rodents; for it seems that, whatever may be the value of the characters by which the species of *Zapus* may be differentiated from typical Murines,—even from *Mus* itself,—equally strong at least, if not stronger, points of difference from *Dipus* or *Pedetes* may be found. I should judge that a classification which distinguishes a family *Dipodidae* from *Muridae* should, in appreciation of taxonomic equivalency, eliminate *Zapus* as the type of a separate family,—one which, as I still contend, is scarcely more closely related to the groups which *Pedetes* and *Dipus* respectively typify than it is to the *Muridae* proper. I find it quite as easy to draw the line between *Zapus* and either *Dipus* or *Pedetes* as it is to separate the same form from *Mus* proper; and accordingly, in indorsing a classification which admits numerous families of the Murine series, I recognize in the type of *Zapus* a group of full family

\* *Myomerpha*, Alston, 1876—approximately equivalent to the *Myoidae* of Gill, 1872.

rank, as was done by Professor Gill in 1872, probably for the first time, although Carus had already proposed *Pedetina*, *Dipodina*, and *Jaculina*, thus making the three groups of co-ordinate value.

Differing, as I do, with the majority of writers, who associate *Zapus* more intimately with *Dipus* and *Pedetes* than with any typical *Muride*, it may be well to compare or contrast the characters that bear upon the case. Certain modifications of the skull and of the metatarsus, and the dental formulæ, are chiefly concerned.

The four families *Muride*, *Zapodide*, *Dipodide*, and *Pedetide* agree in the completeness of the clavicles, anchylosis of the tibia and fibula, particular condition of the angle of the mandible, absence of postorbital processes, and other features characteristic of, or normal in, the Murine series of Rodents.

It is highly characteristic of the *Muride*, as now usually accepted, to possess  $\frac{3-3}{3-3}$  molars, without premolars; the only exceptions, as far as known, being the genus *Sminthus*, which has  $\frac{1-1}{1-1}$  premolars, and the genus *Hydromys*, which has only  $\frac{2-2}{2-2}$  molars (*Alston*). *Zapus* departs from the rule in having  $\frac{1-1}{0-0}$  premolars, and in so much approaches *Dipodide* and *Pedetide*. But these last two families differ between themselves in respect to the premolars, these being absent, or present above only, in *Dipodide*, and present above and below in *Pedetide*. Hence the condition of the premolars fails to be decisive. The state of the molars is likewise not diagnostic. Excepting the genus *Hydromys*, the molars are  $\frac{3-3}{3-3}$  in all of the families in question; and they are indifferently rooted or rootless in *Muride*, rooted in *Zapodide* and *Dipodide*, rootless in *Pedetide*.

It is highly characteristic—almost diagnostic—of *Muride* to possess a particular construction of the anteorbital foramen; this aperture being normally a pyriform slit of moderate or small calibre, bounded externally by a broad plate of the maxillary. *Zapus*, *Dipus*, and *Pedetes* all depart unequivocally from this in having the same opening large or very large, rounded, and (always?) supplemented with a nick or additional foramen below the main aperture. Associated with this condition of the foramen, we find a special state of the zygoma, which is more than ordinarily depressed, and the malar element of which is prolonged up the maxillary to effect suture with the lachrymal; whereas, in typical *Muride*, the malar is a mere splint, joining extended maxillar and squamosal processes. There are some other features, such as shortness and breadth of the brain-case and condition of the auditory

bullæ, in which *Zapodidæ* recede from *Muridæ*, and more closely approach *Dipodidæ*, although the bullæ do not attain to anything like the enormous development witnessed in *Dipodidæ*. On the whole, the skull presents more decided affinities with that of *Dipodidæ* and *Pedetidæ* than with that of *Muridæ*.

In *Dipodidæ* alone are the cervical vertebræ more or less anchylosed; they are free in *Muridæ*, *Zapodidæ*, and *Pedetidæ*.

The elongation of the hinder limbs of *Zapodidæ*, the shortness of the fore, and a correlated bulkiness of the body behind in comparison with that in front, are points which, in *Zapus*, appear to indicate affinity with *Dipodine* forms, and which have undoubtedly been largely considered by naturalists in their location of *Zapus* near *Dipus* and its allies. But has not the significance of these features been overrated? Has not mere resemblance been taken for evidence of closer relationship than really exists? We should note, in the first place, that mere form may be fallacious; witness, for instance, the striking contrast in shape between the closely-related *Geomyidæ* and *Saccomyidæ*. Secondly, although it is highly characteristic of *Muridæ* to have the fore and hind limbs developed to approximately the same degree, yet there are some unchallenged forms of true *Muridæ*, in which the hind limbs are elongated, such being *Gerbillus* and its immediate allies, collocated by Alston as a special subfamily (*Gerbillinæ*) of *Muridæ*. Thirdly, it should be noted that, in spite of the elongation of the pes of *Zapus*, that member retains five perfectly functional digits, supported by as many complete and separate metatarsals; thus falling far short of the extreme modification witnessed in *Dipodidæ*, where there are but three functionally developed digits, with fusion of lateral metatarsals.

Upon the whole, then, while I am far from denying that the *Zapodidæ* are a step away from the *Muridæ*, and take that step direct toward *Dipodidæ*,—as better evidenced by cranial characters than by the structure of the hind limbs,—still I am indisposed to concede that *Zapus* approaches *Dipus* and *Pedetes* so closely that it may be advantageously combined with these in a single family, the three to be contrasted collectively with the *Muridæ*, or with any other one family of the Murine series. In view of the various cross-relationships involved, and the special combination of characters presented by *Zapus*, I continue to accord it full family rank, and consider that it is to be individually contrasted with *Muridæ*, as *Dipodidæ* and *Pedetidæ* likewise are.



The *Zapodidae* may be considered a connecting link (through *Gerbillina*?) between the "central" or generalized structure which characterizes the *Muridae*, and the "peripheral" or specialized type of structure which culminates in *Dipodidae*. The family may be established upon the following combination of characters, superimposed upon those that belong to the Myomorph series at large.\*

CHARS.—Teeth, 18: I.  $\frac{1-1}{1-1}$ ; C.  $\frac{0-0}{0-0}$ ; Pm.  $\frac{1-1}{0-0}$ ; M.  $\frac{2-3}{2-3}$ . Superior incisors compressed, sulcate; premolar small; molars rooted. Cervical vertebrae unanchylosed (cf. *Dipodidae*). Cranial portion of the skull shorter and broader than in *Muridae*. Auditory bullae transverse (cf. *Muridae*), without special development (cf. *Dipodidae*). Anteorbital foramen large, rounded (cf. typical *Muridae*), with a supplementary nick, or additional foramen, at its lower portion. Malar mounting the zygomatic process of the maxillary to effect suture with the lachrymal (cf. *Muridae*). Zygomatic arch styloid, much depressed.

\* I have but recently received Mr. E. R. Alston's convenient and valuable paper on the classification of the Rodents (P. Z. 8 Jan. 1876, pp. 61-98, pl. iv), too late for such use as I should have wished to make of it in the preparation of my monograph of the *Muridae*, which, though still (Dec. 1876) unpublished, has been for some months in the metal.

In this memoir, the author arranges *Zapus* (under the name of *Jaculus*) as one of three subfamilies of *Dipodidae*, which constitute the seventh and last of his series of Myomorphs, *Muridae* being ranged third. In order to fully exhibit the grounds upon which he differs with me respecting the position of *Zapus*,—though our difference is chiefly in our respective estimates of comparative degrees of inter-relationship and the taxonomic value of mutually conceded characters,—his diagnoses of *Muridae*, and of *Dipodidae*, and its three assigned subfamilies, are subjoined.

"Family III. *MURIDÆ*. Lower incisors compressed; no premolars (except in *Sminthina*); molars rooted or rootless, tuberculate or with angular enamel-folds. Frontals contracted. Infraorbital opening in typical forms high, perpendicular, wide above and narrowed below, with the lower root of the maxillary zygomatic process more or less flattened into a perpendicular plate; very rarely the opening is either large and oval or small and subtriangular. Malar short and slender, generally reduced to a spilit between the maxillary and squamosal processes. External characters very variable. Pollex rudimentary, but often with a small nail. Tail generally subnaked and scaly, rarely densely haired. Cosmopolitan. Ten subfamilies. \* \* \*"

"Family VII. *DIPODIDÆ*. Incisors compressed. Premolars present or absent. Grinding-teeth rooted or rootless, not tuberculate, with more or fewer transverse enamel-folds. Skull with the braincase short and broad; infraorbital opening rounded, very large (often as large as the orbit); zygomatic arch slender, curved downward; the malar ascending in front to the lachrymal in a flattened perpendicular plate; facial surface of the maxillaries minutely perforated; mastoid portion of auditory bullae usually greatly developed. Metatarsal bones greatly elongated, often fused into a cannon-bone. Form gracile; front portion of body and fore limbs very small; hind limbs long and strong, with from three to five digits; tail long, hairy. Three subfamilies:—

"A. *Jaculina*. One premolar above. Grinding-teeth rooted. Cervical vertebra free, metatarsals separate. Hind feet with five developed digits. Tail sparsely haired. Nearctic. [One genus,—*Jaculus*.]

"B. *Dipodina*. Premolars present or absent. Grinding-teeth rooted. Cervical vertebra more or less ankylosed. Metatarsals united in a cannon-bone. Hind feet with only three digits functionally developed. Tail thickly haired, often tufted. Palearctic and Ethiopian. [Three genera,—*Dipus*, *Allochaga*, *Platycoomya*.]

"C. *Pedeticæ*. One premolar above and below. Grinding-teeth rootless. Cervical vertebra free. Metatarsals separate. Hind feet with four well-developed digits, with short broad hoof-like nails. Tail bushy throughout, not tufted. Ethiopian." [One genus,—*Pedetes*.]

Trunk enlarged posteriorly, in correlation with the shortness of the fore limbs and great elongation of the hind ones, especially of the pes (cf. *Muridæ* except *Gerbillinæ*); nevertheless, the pes with five perfect and separate metatarsals, and five functionally developed digits (cf. *Dipodidæ*, *Pedetidæ*). Claws not peculiar (cf. *Pedetidæ*). Tail greatly exceeding the trunk in length (cf. most *Muridæ*), very slender, scant-haired (cf. *Dipodidæ*, *Pedetidæ*). Progression saltatorial.

Other characters of less value are adduced as generic under the head of *Zapus*.

#### GENUS ZAPUS, Coues.

- < *Dipus*, sp., ZIMMERMANN, Geogr. Gesch. ii, 1780, 358.—DAVIES, Trans. Linn. Soc. iv, 1798, 155.—BARTON, Trans. Amer. Philos. Soc. iv, 1799, 114.  
 < *Mus*, sp., ZIMMERMANN, Penn. Arkt. Zool. i, 1787, 131 (*Mus longipes*, Zimm., nec auct.).  
 < *Gerbillus*, sp., DESMAREST, Mamm. ii, 1822, 331 (not type).  
 = *Mériones*, FR. CUVIER, Dents des Mamm. 1825, 187 (type. But not *Meriones* of Illiger, Prod. 1811, 82, which is based on *Dipus tamaricinus* and *D. meridianus*).  
 < *Meriones*, AUDUBON & BACHMAN, Quad. N. Am. ii, 1851, 251 (used in an extended sense, to include Old World species of *Dipodidæ*).  
 = *Jaculus*, WAGLER, Natürl. Syst. Amphib. 1830, 23 (type. But not of Jarocki, 1821, nor of early authors).—WAGNER, Arch. für Naturg. 1841, Bd. i, 119.—BAIRD, Mamm. N. Am. 1857, 429.—ALSTON, Proc. Zool. Soc. Lond. 1876, 89.  
 = *Zapus*, COUES, Bull. U. S. Geol. Surv. Terr. 2d ser. No. 5, 1875, 253 (type).

CHARS.—With well-developed internal cheek-pouches. Digits of the hand five, the first of which is rudimentary, with a flat, blunt nail; palms naked, granular, and tuberculate. Digits of the foot five, all functional, and with perfect claws and basal webs; sole naked throughout, the heel smooth, the rest granular and tuberculate. Meatus of the ear capacious, closed with large antitragal and tragal flaps. Pelage coarse and hispid. Size small; configuration modified from an ordinary Murine shape; physiognomy peculiar.

Other characters are fully detailed in the description of the species beyond. Here I may refer again, more in detail, to the grounds (briefly set forth when I proposed the name *Zapus*) upon which a new designation was given to the well-known genus; for I insist that a new name was required.

The generic type in question has been successively called *Dipus*, *Mus*, *Gerbillus*, *Mériones* or *Meriones*, *Jaculus*, and *Zapus*. Which of these names is tenable?

The first three—*Dipus*, *Mus*, and *Gerbillus*—are too obviously inapplicable to be brought into the question at all. Their unavailability in this connection is now conceded by all.

1. *Jaculus*, or, in its older forms, *Iaculus* and *Iaculus*, was the specific

name of a Linnean species of a family distinct from *Zapodidae*, and was also used, by various of the older writers, both specifically and generically. Thus, *Iaculus* is a generic term used for the Jerboas by Erxleben (Syst. Nat. 404, No. 38) in 1777, long before *Zapus hudsonius* had been discovered. It should, therefore, not have been imposed upon any subsequently determined generic type. But even according to the rule, custom or precedent, which permits an author who subdivides an old genus to restrict the name of such genus to any one of his new genera he may see fit, *Jaculus* is still inapplicable to the present genus; for such restriction seems to have been first made by Jarocki,\* a Polish naturalist, who, in 1821, employed the term *Jaculus* for certain pentadactyle species of *Dipodidae*, the name becoming, at his hands, exactly equivalent to the subsequent *Alactaga* of Fr. Cuvier (Proc. Zool. Soc. 1836, 141), afterward altered, on account of its barbarous character, to *Scirtetes*, by Wagner (Arch. für Naturg. 1841, Bd. i, 119). Clearly, then, if *Jaculus* is available for any modern genus, it must be for one of the *Dipodidae*, and can have nothing to do with the present case. It is as much out of the question, in fact, as either *Dipus* or *Gerbillus*.

So far as I am aware, *Jaculus* was first used in connection with the present genus by Wagler, in 1830 (Natürl. Syst. Amphib. u. s. w.). In this procedure, however, he was followed by no writers of note until A. Wagner,† in his "Gruppierung der Gattungen der Nager in natürlichen Familien" u. s. w. (Arch. für Naturg. 1841, Bd. i, p. 119), used "*Jaculus* Wagl." as equivalent to, and instead of, *Meriones* Cuv. The name, however, did not come into general employ in this connection until 1857, when Professor Baird adopted it in the same sense which Wagler and Wagner had attached to it; and his example has been generally followed by the American school.

2. The term *Meriones* was invented by Illiger in 1811 (Prod. Syst. Mamm. et Avium, etc. p. 82, No. 32), to cover the Old World species "*Dipus*

\* Jarocki's work I have not been able to consult. The title and reference, as given by A. Milne-Edwards, after Brandt, are:—"Zoologia Cayli Zwiertopismo ogolne. Warszawa, 1891. pl. i, p. 96." Milne-Edwards observes: "Jarocki réserve le nom générique de *Dipus* aux Gerboises dont les pattes postérieures sont tridactyles, et constitue sous le nom de *Jaculus* un nouveau genre pour les espèces à pattes postérieures pentadactyles."—"Études pour servir l'histoire de la Faune Mammalogique de la Chine," apud H. Milne-Edwards's "Recherches," etc., tome I, pp. 146, 147. 4to, Paris, 1868-74).

† Says Professor Wagner (tom. cit. 120): "Hinsichtlich der Benennung der amerikanischen Springmäuse erinnere ich, dass ihnen der Name *Meriones*, den Fr. Cuvier auf sie überträgt, nicht beigelegt worden sollte, indem ihn Illiger an Nager der alten Welt vorgeben hat; ich bediene mich daher des von Wagler vorgeschlagenen Namens *Jaculus*." That is to say, Professor Wagner objects to M. Cuvier's transferring Illiger's *Meriones* to the American type, without seeming to be aware that he is doing the same thing himself,—transferring *Jaculus* to this type.

*tamaricinus, meridianus* LinGmel."; the author quotes "*Cerbillus* Desm." as a synonym; the diagnosis of the genus is not applicable to *Zapus*; and, as if to clinch the matter, Illiger expressly enumerates "*Dipus canadensis* Shaw" under a preceding genus, *Dipus*. Hence it is clear that *Meriones*, as proposed by Illiger, had no reference, even by implication, to the American type *Zapus*. But, a few years afterward, in 1825, Fréd. Cuvier (*Dents des Mammif. etc.* p. 187) committed the Gallicism of *Meriones*, and said: "Le type de ce genre est le *dipus americanus*, de Barton." without the slightest allusion to Illiger,—just as if he were proposing a new genus. All that he did, however, was to transfer Illiger's name to a totally different generic type, to which Illiger never intended it to apply. The case is parallel with that of Wagler's and Wagler's transferring of *Jaculus* from certain Old World types to the American one. It is immaterial whether or not *Meriones* is tenable for the group upon which Illiger based it; it certainly cannot stand for any other group.

Hence it is clear that the American animal never had a name based upon itself, nor any tenable name, until *Zapus* was proposed. In establishing the genus, I thought it unnecessary to more than briefly allude to the facts in the case; but, as I observe some indisposition to coincide in this instance with my views, I have thought proper to set forth my reasons at length.

## ZAPUS HUDSONIUS, Coues.

## SYNONYMY.

- Dipus hudsonius*, ZIMMERMANN, Geog. Gesch. ii, 1780, 358, No. 268 (based on the Long-legged Mouse of Hudson's Bay, of Pennant).—BODDERT, Elench. Anim. i, 1784, 115 (based on Zimmermann).—SCHREBER, "Säu. . . 861, No. 6".—FISCHER, Syn. Mamm. 1829, 340 (based on Zimmermann).
- Gerbillus hudsonius*, RAFINESQUE, Am. Month. Mag. 1818, 446.—LESSON, Man. i, 1827, 257.
- Meriones hudsonius*, AUDUBON & BACHMAN, Q. N. A. ii, 1851, 251, pl. 85.
- Jaculus hudsonius*, BAIRD, P. R. R. Rep. x, 1859, Gunnison's & Beckwith's Routes, Mamm. p. 8.—COOPER & STUCKLEY, Nat. Hist. Wash. Terr. 1860, 83, 101, 127.—HAYDEN, Trans. Amer. Philos. Soc. xii, 1862, 147 (Fort Union).—SAMUELS, Ninth Ann. Rep. Mass. Board Agric. 1869, 178 (habits).—GILPIN, Proc. & Trans. Nova Scotia Inst. ii, 1870, 60 (Nova Scotia).—ALLEN, Bull. Mus. Comp. Zool. i, 1870, 226 (Massachusetts).—TENNEY, Am. Nat. vi, 1872, 330, f. 101 (habits).—MERHAM, Ann. Rep. U. S. Geol. Surv. Terr. for 1871, 1872, 665.—AMES, Bull. Minn. Acad. i, 1874, 70 (Minnesota).—ALLEN, Bull. Ees. Inst. vi, 1874, 60, 65 (Wyoming and Utah).
- Zapus hudsonius*, COUES, Bull. U. S. Geol. & Geog. Surv. Terr. 2d ser. No. 5, 1875, 254.—COUES & YARBROW, Zool. Expl. W. 100 Merid. 1875, 99.
- Mus longipes*, ZIMMERMANN, Penn. Arkt. Zool. i, 1787, 131 (erroneous identification with *Mus longipes* auct.).
- Mus canadensis*, "PENNYANT" (merely Latin rendering of "Canada rat"?)
- Dipus canadensis*, DAVIES, Trans. Linn. Soc. iv, 1798, 157, pl. 8, f. 5, 6 ("Jumping Mouse of Canada").—SHAW, Gen. Zool. ii, 1801, 192, pl. 161 (after Davies).—TURTON, Syst. Nat. i, 1806, 100.—ORD, Guthrie's Geog. 2d Am. ed. 1815, 292.—FISCHER, Syn. Mamm. 1829, 330.
- Gerbillus canadensis*, DESMAREST, Mamm. ii, 1822, 331.—HARLAN, Fd. Amer. 1825, 155.—GODMAN, Am. Nat. Hist. ii, 1st ed. 1893, p. —; 2d ed. 1891, 94, pl. —; 3d ed. 1891, 94.—GRIFFITH, Anim. Kingd. v, 1827, 240, No. 624.—EMMONS, Rep. Quad. Mass. 1840, 69.—THOMPSON, Nat. Hist. Vermont, 1853, 41.—HALL, Canad. Nat. & Geol. vi, 1861, 304 (Montreal).

- Meriones canadensis*, LESS., Man. i, 1827, 258.—SCHINZ, Syn. Mamm. ii, 1845, 91.  
*Dipus americanus*, BARTON, Amer. Philos. Trans. iv, No. xii, 1799, 115 (plate, not numbered, opp. p. 124).—  
 BARTON, op. cit. vi, 1804, 143 (habita).—ORD, Guthrie's Geog. 2d Am. ed. 1815, 292.  
*Meriones americanus*, FR. CUVIER, Dents des Mamm. 1825, 187, No. and pl. 75, figs. a, b (teeth. Name not  
 formally presented, but inferable from the context).  
*Jaculus americanus*, WAGLER, Naturf. Syst. Amphib. 1830, 23.  
*Meriones americanus*, DEKAY, N. Y. Zool. i, 1842, 70, pl. 24, f. 2.  
*Dipus labradorius*, TUXTON, Syst. Nat. i, 1806, 99 (Labrador Rat of Pennant).—ORD, Guthrie's Geog. 2d  
 Am. ed. 1815, 292.  
*Mus labradorius*, J. SABINE, App. Frankl. Journ. 1823, 661.  
*Gerbillus labradorius*, HARLAN, Fu. Amer. 1825, 157 (after Sabine).—GODMAN, Am. Nat. Hist. ii, 1st ed.  
 1826, p. —; 2d ed. 1831, 97; 3d ed. 1861, 97.—GRIFFITH, Anim. Kingd. v, 1827, 240, No. 635.  
*Dipus labradorius*, FISCHER, Syn. Mamm. 1829, 338.  
*Meriones labradorius*, RICHARDSON, F. B.-A. i, 1829, 144, pl. 7.—WAGNER, Suppl. Schreb. iv, pl. 226 B  
 (after Richardson).—DAWSON, Edinb. N. Philos. Journ. new ser. iii, 1856, 2.  
*Meriones labradorius*, SCHINZ, Syn. Mamm. ii, 1845, 92.  
*Jaculus labradorius*, WAGNER, Suppl. Schreb. iii, 1843, 294.—GIEDEL, Säug. 1855, 599; Zeitschr. gesammte  
 Naturw. xxv, 1865, 272 (osteology).—KENNICOTT, U. S. Patent Office Agric. Rep. for 1856,  
 1857, 95, pl. 11 (habita).—MAXIMILIAN, Arch. Naturg. 1861, p. —; Verz. Reise N.-Am. 1862, 146.  
*Gerbillus sylvaticus*, "MITCHELL" (descr. nulla).  
*Meriones nemoralis*, IN. GEOFFROY, "Diet. Class. vii, 323; pl. fasc. 10, n. 2".  
*Gerbillus dacotii*, RAFINESQUE, "Préc. Découv. Sém. 14".  
 ? *Gerbillus soricinus*, RAFINESQUE, "Préc. Découv. Sém. 14".—DESMAREST, Mamm. ii, 1822, 322 (com-  
 piled from Rafinesque).—LESSON, Man. i, 1827, 257 (compiled from Rafinesque).  
 ? *Dipus soricinus*, FISCHER, Syn. Mamm. 1829, 339 (compiled from Rafinesque).  
 ? *Gerbillus leonurus*, RAFINESQUE, Am. Month. Mag. 1818, 446.—DESMAREST, Mamm. ii, 1822, 322 (compiled  
 from Rafinesque).—LESSON, Man. i, 1827, 257 (compiled from Rafinesque).  
 ? *Dipus leonurus*, FISCHER, Syn. 1829, 339 (compiled from Rafinesque).  
 ? *Gerbillus megalops*, RAFINESQUE, Am. Month. Mag. 1818, 446.—DESMAREST, Mamm. ii, 1822, 322 (compiled  
 from Rafinesque).—LESSON, Man. i, 1827, 257 (compiled from Rafinesque).  
 ? *Dipus megalops*, FISCHER, Syn. 1829, 340 (compiled from Rafinesque).  
 ? *Gerbillus macronurus*, RAFINESQUE.  
 ? *Gerbillus brachyurus*, RAFINESQUE.  
*Meriones microcephalus*, HARLAN, Proc. Zool. Soc. Lond. vii, 1839, 1.—SCHINZ, Syn. Mamm. ii, 1845, 92  
 (compiled from Harlan).  
*Meriones acedius*, DAWSON, Edinb. N. Philos. Journ. new ser. iii, 1856, 2, pl. 1.  
*Canada Rat*, PENNANT, Quad. ii, 179.  
*Labrador Rat*, PENNANT, Hist. Quad. 1781, 435, No. 205; Arct. Zool. i, 1784, 139, No. 63.  
*Jumping Mouse of Canada*, DAVIES, l. c.  
*Labrador or Jumping Mouse*, GODMAN, l. c.  
*Canadian Jerboa*, SHAW, l. c.  
*Labradore Jerboa*, TURTON, l. c.  
*Canadian and Labrador Gerbil*, GRIFFITH, l. c.  
*Deer Mouse*, DEKAY, l. c.  
*Gerbille du Canada*, DESMAREST, l. c.  
*Mérione du Canada*, LESSON, l. c.  
*Gerbille soricine, de la baie d'Hudson, queue de lion, et aux yeux noirs*, LESS., l. c.  
*Canadische, Labradorische, Kleinköpfige Hüpfmaus*, SCHINZ, l. c.

## DESCRIPTION.

A. *Cranial characters*.—In comparison with the Murine forms with which it has been associated, this animal presents many strong peculiarities of the skull and teeth. Among these may be enumerated the presence of an additional tooth in the upper molar series, causing an inequality in the form of the two jaws; the size and shape of the anteorbital foramen, with its

supplementary foramen or nick just beneath; the extension of the malar bone up the slender styloid zygomatic portion of the maxillary till it sutures with the lachrymal, and the slenderness and depression of the rest of the zygomatic arch; the shortness and transverse position of the bullæ auditiæ; the position of the maxillo-palatine suture; expansion of the posterior nares, &c. The skull, as a whole, is shorter for its width, though the zygomata are more nearly parallel; it is also deeper for its other dimensions, with a greater degree of convexity, both lengthwise and crosswise, of the superior contour. Nevertheless, its general superficial resemblance to that of *Mus* proper is evident. Compared with that of *Mus musculus*, which is of about the same size, we see in each species the same general shape and delicate papery condition, without strong angularity, as well as many close coincidences in detail, indicating that the Murine affinities of the animal are with typical *Mus*, *Hesperomys*, &c., and not with the Arvicoline group of *Muridæ*, in which the skull is notably heavier, more massive, and more angular.

As to the general shape of the skull, there is little to be added to the foregoing, except such points as, being equally applicable to the familiar *Mus musculus*, need not be recapitulated; we may therefore at once proceed to details, in giving which I frequently compare the skull with that of *Mus* to indicate its departures from ordinary Murine features.

The anteorbital foramen, which transmits the masseter in this instance, and which constitutes a prime peculiarity of the skull, is of great size and obliquely oval in shape. Instead of being circumscribed by a plate of bone, as in *Muridæ*, it is defined externally by a very slender styloid process of the maxillary, which is strengthened by the upward extension of the malar, applied as a splint along its whole length. Below this main foramen there is another much smaller one, which transmits the nerve. This is sometimes a complete foramen, separate from the other; sometimes only a deep notch in the lower border of the main opening; and this difference may be observed on the two sides of the same skull. I am ready to believe that this lesser opening, giving passage to the superior maxillary nerve, is the true "anteorbital" foramen itself; for it seems to correspond to the lower part of the large slit which, in *Muridæ*, is walled in by the maxillary lamina, and it is formed by a little plate of bone, which rises as a ridge from the alveolar portion of the jaw, and bends over to abut against the main wall of the maxillary. In cases in which this plate fails to reach the main wall of the maxillary, so that

only a notch and not a foramen results, the correspondence of the whole opening with the pyriform slit of the *Muridae* is very evident, and the relation of the parts is fully established, though the shape is quite different.

The contour of the parts surrounding the foramen is such that the zygomatic process of the maxillary stands out at a right angle at a point scarcely above the level of the alveoli. The anterior root of the zygoma is hence notably depressed in position; there being no forward-upward reach of the lower border of this arch, so evident in *Muridae*. The zygoma, in fact, is nearly horizontal in all of its length along the under side; but anteriorly the upper edge rises prominently, in consequence of the unusual extension of the malar up the maxillary, already mentioned. The malar runs all the way up to the lachrymal bone, affording a circumstance which I believe to be rare, namely, a lachrymo-malar suture like that which is found in *Dipodidae* and *Pedetidae*. This ascending spur of the malar is, moreover, expanded into a rather broad lamina, partly defending the orbit, thus supplying a wall that, in most cases, is afforded by expansion of the zygomatic process of the maxillary; the latter being in this case of styloid character. In its continuity, the malar is a slender rod; behind, it underlaps a short spur of the squamosal with simple squamous suture.

The general shape of the orbit is much the same as in *Mus*. In both, the squamosal forms much of the posterior orbital wall; the orbito-sphenoid being correspondingly reduced. The antero-exterior corner of the parietal reaches to the brim of the orbit.

The rostral portion of the skull bears to the rest about the same proportion as in *Mus*, and is equally attenuate anteriorly, though thicker at the base, and consequently more tapering. The ends of the nasals project conspicuously beyond the plane of the incisors; behind, these bones terminate opposite the ends of the intermaxillaries; the suture of the frontal with each of them, as well as with the maxillaries, being nearly in one transverse jagged line. The intermaxillaries develop a strong alveolar plate, separating the superior incisors for nearly half their length; this, with the projection of the nasals and backward set of the much-curved teeth, results in a snout strikingly like that of the *Sacomys*. The feeble, retreating under jaw, densely hairy upper lip, and small nasal pads bear out this resemblance in the external physiognomy.

As in *Mus*, the interorbital constriction is moderate, being about as wide



as the rostrum at base; and there is no trace of a postorbital process. The parietals are nearly square, though somewhat emarginate in front, to correspond with the convexity of the frontal. There is little, if any, dipping-down of a postero-exterior angle, so well exhibited in *Mus*. The interparietal is of large size transversely, though narrow in the other direction; it reaches across the whole width of the combined parietals, bounding them both posteriorly, as it is itself bounded by the occipital. The extent of this narrowly elliptical transverse interparietal is greater than in *Mus*; its corner is at a point where the back outer angle of the parietal, back upper angle of the squamosal, and front upper angle of the occipital all come nearly together. The squamosal closely resembles that of *Mus* in size, shape, and connections; there are the same extensive vacuities about the petrosal, with a similar strong clasp, bridging over the opening just above the meatus, running from the root of the zygomatic process to the back edge of the bone. The mastoid is of moderate size, developing nothing to be fairly called a process, wedged between the paroccipital process and the squamosal, at the postero-lateral corner of the skull. It is confluent with the petrosal, but partially fissured away from the surrounding occipital elements. The supraoccipital is of large size and convex contour; the occipital crest is slight, so that the plane of the occiput is not well defined from that of the superior surface of the skull, the two meeting with a continuous curve, more convex than in *Mus*. The upper border of the occipital is nearly straight, and bounded quite across by the interparietal; next comes a considerable piece of squamosal suture, and then the mastoid. The foramen magnum is of great size and nearly hexagonal shape; most of it being in the plane of the occiput, with only a slight nick inferiorly. The condyles are protuberant and convergent; the condyloid foramen is close beneath their articular surfaces. The paroccipitals are well-marked perpendicular processes. The basioccipital narrows very rapidly, owing to the strong inward trend of the petrosals, and ends by transverse suture, as usual, with the basisphenoid, opposite the ends of the petrosals. Its under surface shows a pair of slight depressions, with a median ridge.

The posterior nares are of ample dimensions, owing to the wide separation of the pterygoids. These bones are long, straight, and styloid, with a slightly-clubbed extremity in close approximation to the ends of the petrosals. The palate ends behind with a broad, rounded emargination opposite the last molars. This formation is very different from that of *Mus*, in which the bony



palate extends back of the molar series, and the contracted interpterygoid space is narrowly angular. The maxillo-palatine suture of *Zapus*, likewise, is differently located, being opposite the interspace between the penultimate and preceding molar, instead of much farther back. There is a pair of conspicuous palatal foramina opposite the penultimate molar. The contour of the palate differs from that of *Mus*, and perhaps a majority of allied Rodents, in being broader in front than behind. The incisive foramina are of great length, as well as quite broad, reaching from little behind the incisors to opposite the molars; the perforation is half in the intermaxillary, half in the maxillary; the bony septum is swollen except at its posterior part.

The form of the descending process of the mandible is a strong character of *Zapus* in comparison with *Mus*, &c., in which this plate of bone is more or less squarish, and vertical or nearly so. In *Zapus*, the same plate is strongly twisted out of the axis of the jaw, standing diagonally outward and upward,—very much, in fact, as in *Sacomys*. The coronoid is rather weak, falcate, acute, with a strong slope; it slightly overtops the condyle. The latter sets strongly backward, though it is rather more erect than in *Mus*. The incisor causes a moderate protuberance outside, at the root of the condylar process. Inside, nearly opposite, is the conspicuous foramen of the inferior maxillary nerve.

B. *Dental characters*.—The superior incisors are short and stout, with a strong curve; their anterior faces strongly sulcate, with the outer half of the tooth rabbeted down so that the groove is plainly visible from the side. The inferior incisors are not specially noteworthy. The molar series differs from that in *Muridae* proper (except *Sminthus*) in the presence of a small premolar in the upper jaw, with no tooth to correspond in the lower series. This minute premolar is single-rooted; the three following teeth have three roots apiece,—a lengthwise pair of slender fangs outside, and a single stout fang, apparently formed of two coalesced roots, inside. The lower molars have each a pair of roots, in single lengthwise series. The upper premolar is the smallest of the whole, and simply circular; the next two are about equal in size; the last is much smaller. A similar proportion is seen in the under series. The pattern of the molar crowns is much complicated.

C. *External characters*.—A general Murine form is modified by the great development of the hind limbs (much as in *Dipodidae* or some forms of *Sacomys*), and especially of the pes itself; an unusual length of tail, which

greatly exceeds that of the body; a peculiar condition of the external ear; and a physiognomy quite like that of the *Succomyida*. There are also well-developed internal cheek-pouches, shared, in a less degree however, by various American *Muridæ*.\* These pouches, as well as can be judged from alcoholic specimens, are relatively about as large as those of *Tamias* for instance.

The body of *Zapus* is large behind, in correlation with the greatly-developed posterior limbs, and tapers to the fore in a regular manner; the head being comparatively small, and there being no noticeable constriction of the neck. The head is conoidal, with a prominent and rather blunt snout and retreating under jaw. The rather small eye is midway between the nose and ear. The upper lip is not visibly cleft, and is densely hirsute, with a fringe of hairs depending over and almost hiding the small front teeth. The naked muffle is of rather small size, and entirely inferior in position; above it, the hairy skin crosses with a deep transverse crease, forming a sort of imperfect overhanging flap, which is freely movable back and forth, even in alcoholic specimens, and looks as if it might be drawn down to partially cover the nostrils. (I have observed much the same thing in *Sacomyida*.) The nose-pad is impressed with a pair of median vertical grooves, and a transverse one is seen in some cases. The nostrils are completely lateral in position. The whiskers are rather sparse, but some of them are nearly half as long as the body.

The structure of the external ear is rather remarkable (among Rodents) for the provision for perfect closure of the meatus, as in the *Soricida* for instance. The antitragus develops into a great flap, completely reversible, and capable of being applied against the meatus; and such, in fact, appears to be its usual position. The tragus, likewise, expands into a wide frill, or thin, free, rounded border, which ordinarily lies in apposition with the antitragal lobe opposite, completing the closure of the ear. On turning over these two flaps, the vestibule of the ear is seen to be of unusually large dimensions. The conch itself is of an ordinary contour, coming to a blunt

\* The presence of cheek-pouches in the genus *Hesperomys* was first noted in 1830 by Gapper, who referred specimens of the common *Hesperomys leucopus* to *Cricetus* on this account, establishing a species *C. myoides*. In this matter, he was succeeded by Baird in 1857, who also recognized the pouches, and endorsed a *Hesperomys myoides* mainly upon this feature, failing, however, to observe that they also existed in other species of the same genus. At the same time that Mr. J. A. Allen announced the before unknown pouches of *Zapus hudsonius*, he also showed that they occurred as well in various species of *Hesperomys*; and my subsequent dissections have satisfied me that pouches are present in all the North American species of *Hesperomys* proper; i. e., the subgenus *Vesperimus* as established by me: Proc. Acad. Nat. Sci. Phila. 1874, 178.

point above; the anterior third is folded close back. The back of the ear and the fold of the couch are sparsely pilous; the exposed parts of the front of the ear being more thickly clothed. The antitragal pad bears on its outer surface a special tuft of long hairs; its other side being naked, as are both sides of the flap of the tragus.

The fore limbs are absolutely small, as well as short in comparison with the hinder ones; and they seem to be placed rather far forward, though this appearance may be due, in part at least, to the tapering shape of the body. The hands are pilous above, naked below. There are four perfect fingers, with ordinary claws, and a rudimentary thumb, which bears a flat, blunt nail. The third digit is the longest; the fourth, second, and fifth being successively shortened. The digits are regularly transversely scutellate below. The palm is granular throughout, with a pair of large smooth pads (inner and outer) near the wrist, and three smaller tubercles at the bases of the digits; two proper to the second and fifth, respectively, one common to the third and fourth.

The elongation of the hind limbs, which confers the high degree of saltatorial power upon this animal, like that of *Dipus*, &c., is especially noticeable in the pes, which exceeds the crus in length. This development of the foot, nevertheless, is not accompanied by reduction of the digits in number, nor by any imperfection of their respective metatarsals. The number of these bones has been queried: I find five, perfect from end to end, with complete tarsal and phalangeal articulations. The foot is clothed above with short, soft, silky hairs, quite different from the hirsute pelage of the body; below, it is entirely naked, though the lateral fringe of hairs encroaches upon the contracted heel. The sole is perfectly smooth (as in *Mus*) for about half-way, then granular; the digits are transversely scutellate underneath. There is a well-defined tubercle on the inner side a little distance above the base of the first digit, and four others at the bases of the digits; three proper to the first, second, and fifth, respectively, one common to the third and fourth. There are five perfect and normally-clawed digits. The first is shortest, and also situated rather high up, so that its tip reaches only to about the base of the second. The fifth is next longer, reaching the middle of the fourth. The third slightly exceeds the fourth and second, which are about equal to each other. There is much basal webbing between the three intermediate digits, especially between the third and fourth, which carries their apparent bases far beyond the bases of the lateral digits.

In its relative length, the tail exceeds that of any other North American (mammal?) Rodent, always greatly exceeding the head and body, and sometimes measuring nearly twice as much. It is cylindrical, with uniform taper and very slight caliber, coming to a fine point with a slight pencil of hairs. Its hairiness is about on a par with that of *Mus musculus*, *decumanus*, &c.; that is to say, insufficient to hide the verticillate whorls of scales between which the short hairs spring.

The general pelage of this animal is coarse and hispid, with little gloss, and presenting a streaky or "staring" appearance, owing to the number of bristly hairs which are mixed with the softer under fur. The color varies a good deal in different specimens, though one pattern is pretty constantly preserved. About one-third of the colored part of the fur—that is to say, a dorsal strip about as wide as the lateral strip on either side—is brownish-yellow, heavily shaded with brownish-black. The sides, with the outer surface of the limbs, are of this same sandy-yellowish, but so slightly lined with the blackish that the purity of the light color is scarcely interfered with. The under parts are snow-white, with a pretty sharp line of demarkation from the colored areas. The backs of the hands and feet are whitish. The tail is rather indistinctly bicolor, to correspond with the body-areas,—dark brown above, whitish below. The ears have a light-colored rim. The whiskers are mostly black. The basal part of the fur, in the colored areas, is gray or plumbeous, excepting just along the line of junction of the tawny of the sides with the white of the belly, where the hairs are white to the roots, like those of the belly. To this absence of dark bases of the hairs is due the appearance of a fulvous stripe along the sides, sometimes quite strongly marked, much as in species of *Perognathus* or *Cricetodipus*. In these cases, there are thus four styles of coloration from back to belly: the dark dorsal area, mixed blackish and sandy, with plumbeous roots; sandy, with little or no blackish, but still with gray roots; sandy, with white roots; and, finally, pure white. The variations to which the species is subject lie in the brightness or dullness of the tawny, and its lining with a varying amount of blackish; the degree of distinctness of the dorsal area from that of the sides, and of this from the white of the belly; and in the sharpness or indistinctness of the tawny lateral stripe along which the hairs are white at the roots. The line of the belly-white is pretty constantly sharp, as in *Hesperomys*; but there is often a gradual shading from the dark dorsal area to the tawny

of the sides, and the latter is sometimes very pale yellowish-gray, &c. I have observed no plumbeous or entirely gray stage like that frequently or usually seen in young *Hesperomys*; and I have failed to determine what definite relation, if any, the observable differences in coloration bear to sex or age.

The animal varies much in size, and to some extent in proportions, especially the length of the tail. This is the most variable dimension, as usual in all such cases of high development of parts. A tendency to superior size in specimens from the Rocky Mountains and westward has been noted. The following table of measurements of an alcoholic series indicates very fairly the dimensions, and, to some extent, the variations in size and proportions:—

TABLE I.—Measurements of twenty-one alcoholic specimens of *ZAPUS HUDSONIUS*.

Skulls measure from 0.90 to 1.00 by 0.45 to 0.50.								
National Museum number.	Locality.	From tip of nose to—				Tail—	Length of—	
		Eye.	Ear.	Occiput.	Tail.	Vertebrae.	Fore foot.	Hind foot.
2593	Halifax, N. S.	*0.45	0.60	1.00	2.75	5.00	0.40	1.20
2303	Middleboro', Mass.	0.44	0.75	1.00	2.90	5.29	0.35	1.18
2385	do.	0.45	0.90	1.00	3.00	5.00	0.37	1.30
2386	do.	0.44	0.80	0.95	2.75	4.50	0.45	1.18
2397	do.	0.40	0.60	0.95	3.00	5.30		
2398	do.	0.43	0.85	1.00	2.75	4.75	0.35	1.15
2594	Burlington, Vt.	0.45	0.90	1.00	3.30	5.35	0.40	1.18
2599	Wethersfield, Conn.	0.45	0.90	1.00	2.75	4.80	0.40	1.10
2600	do.	0.45	0.80	1.00	2.75	4.35	0.35	1.15
2603	Waterville, N. Y.	0.45	0.90	1.10	3.10	4.95	0.45	1.15
2606	do.	0.50	0.95	1.00	3.25	5.00		
2607	do.	0.45	0.85	1.00	2.85	4.90	0.40	1.15
2608	do.	0.45	0.90	1.00	3.00	5.00	0.40	1.15
2604	Philadelphia, Pa.	0.45	0.85	1.00	2.90	4.85	0.45	1.13
2601	Carlisle, Pa.	0.45	0.85	1.00	2.85	4.70	0.45	1.15
2602	do.	0.45	0.85	1.00	2.85	4.75	0.45	1.15
2603	do.	0.40	0.80	0.95	2.60	4.40	0.40	1.05
2611	West Northfield, Ill.	0.40	0.80	0.90	2.80	4.70	0.40	1.10
2612	Upper Missouri River.	0.50	1.00	1.15	3.00	5.10	0.48	1.15
1920	Platte River, Nebr.	0.40	0.80	0.95	2.75	4.50	0.45	1.18
2020	Stellacom, W. T.	0.45	1.00			6.10	0.50	1.35
	Average	0.44	0.86	0.99	2.80	4.90	0.43	1.15

\*All measurements are in English inches and decimals.

## GEOGRAPHICAL DISTRIBUTION.

The dispersion of *Zapus hudsonius* in North America can at present be given only in somewhat general terms, pending precise information respect-

ing both northern and southern limits of its distribution. It inhabits the greater part of British America and the United States, from Atlantic to Pacific. The northernmost recorded locality I have noted is Great Slave Lake, latitude 62°; and the southernmost is Virginia, where I have myself observed it. It was originally described from Hudson's Bay, Labrador, and Canada, and appears to be particularly numerous in the last-named region and northern half of the United States. Audubon surmises, with much reason, that it exists south of Virginia, at least in mountainous regions; while there is no doubt of its presence in elevated portions of Arizona and New Mexico, which harbor such a truly boreal animal as *Gulo luscus*. We have found it in Dakota, and it is known to occur on the Pacific coast, in Washington Territory; while the moist and comparatively warm climate of the wooded region, thence northward, we may properly surmise, will carry its habitat far into Alaska. Its dispersion will probably ultimately prove to be little, if any, less extensive than that of *Hesperomys leucopus*; although, as it is more strictly a woodland animal, there are large treeless areas within its general range where probably it does not exist.

## HISTORY OF THE SPECIES

The latter part of the last century gave us our earliest accounts of this species, under various names, from three apparently separate and independent sources,—Pennant, Davies, and Barton. Thomas Pennant is said to have first described the animal under the name of the "Long-legged Mouse of Hudson's Bay", or some equivalent expression;\* and this became the basis of the first technical appellation quoted. *Dipus hudsonius*, conferred by Professor Zimmermann in 1780. Pennant erred in hastily identifying the animal sent from Hudson's Bay by Mr. Graham with the *Mus longipes* of Pallas, or *Dipus meridianus* of Gmelin, an Asiatic quadruped. The same author had also a "Labrador Rat", which is no other than the present species. J. Sabine is currently accredited with the term *Mus labradorius*, derived from this source; but a *Dipus labradorius* had before appeared, upon the same basis, in Turton's English version of the Linn.-Gm. Systema Naturæ (1806).

About the year 1798, General Thomas Davies communicated to the Linnean Society an account of an animal he called the "Jumping Mouse of Canada", which was published in the Transactions† of that body for 1798, the

\* The reference is not at hand as I write.

† An Account of the Jumping Mouse of Canada. By T. Davies. < Trans. Linn. Soc. iv, 1798, pp. 155-157, pl. 8, two lower figs. Named *Dipus canadensis* on p. 157.

species being called *Dipus canadensis*. The article was immediately copied into Tilloch's Philosophical Magazine,\* with reproduction of the colored plates by which it was illustrated. These same figures, representing the animal in activity and in repose, were also copied by Dr. G. Shaw in his General Zoölogy in 1801 (plate 161), and the species became established upon this name "*canadensis*", already the third one bestowed upon it.

The fourth designation of the species, "*Dipus americanus*", is derived from Barton; it really anticipated Davies's "*canadensis*", though not in date of publication. In the year 1795, Prof. B. S. Barton communicated an account of the species to the American Philosophical Society, which body published it in the fourth volume of their Transactions,† bearing date 1799. In this article, the learned and ingenious author named a species, *Dipus americanus*, on page 115; he discussed at length its probable relationships with *Dipus hudsonius* of Zimmermann, and with "*Mus longipes*", coming to the conclusion it was distinct; and finished with an interesting account of its habits. Some years later, the same writer presented to the society a second paper‡ on the species, devoted to further consideration of the creature's habits, with special reference to its torpidity or hibernation. These excellent accounts of Professor Barton's have probably not been excelled in accuracy of detail.

We thus see how the species came to be generally known by three different names,—*hudsonius*, *canadensis*, and *labradorius*,—to say nothing of the "*Mus longipes*". Later authors are nearly equally divided in their use of those terms, but *hudsonius* clearly has priority. Coming to later synonyms, I find a quotation of a *Gerbillus sylvaticus*, a name said to have been proposed by S. L. Mitchill, without accompanying description; and also of a *Meriones nemoralis*, attributed to Is. Geoffroy St. Hilaire. These references I have not been able to verify.

After treating of "*Gerbillus*" *canadensis*, in his Fauna Americana, in 1825, apparently from fair acquaintance with the animal, Dr. R. Harlan, in 1839,§ described specimens from Philadelphia as a new species under the

\* An Account of the Jumping Mouse of Canada, *Dipus canadensis*. By T. Davies. < Tilloch's Phil. Mag. i, Aug. 1798, pp. 285-287, pl. viii, figs. (colored) 1, 2. (From Tr. Linn. Soc. iv, 1798, pp. 155-167.)

† Some account of an American species of Dipus or Jerboa. < Trans. Amer. Philos. Soc. iv, No. xii, pp. 114-124, with pl. not numbered opp. p. 124. "Read" 1796; vol. dated 1799.

‡ Supplement to the account of the *Dipus americanus*, in the IV. Vol. of the Transactions of the Society. Soc. No. XII. < Trans. Amer. Philos. Soc. vi, 1804, pp. 143, 144. Read Dec. 1803; vol. dated 1804.

§ On a New Species of Meriones. < Proc. Zool. Soc. Lond. vii, Jan. 1839, p. 1. Subsequent to the collection of the author's papers published by Lydia R. Bailey, under the title of "Medical and Physical Researches" (8vo, Philada. 1835).



name of *Meriones microcephalus*. In 1856, Principal J. W. Dawson re-described\* the species as new, from Nova Scotian examples, under the name of *Meriones acadicus*. But the characters adduced by these authors in neither case indicate specific distinction, viewed in the light we now have on the normal variability of this animal.

Though scarcely pertaining legitimately to the history of the species, numerous vague indications by Rafinesque of American species of "*Gerbillus*" may be here alluded to. The original quotations, together with the accounts compiled, chiefly by certain French writers, from Rafinesque, will be found in the foregoing list of synonyms. If the several supposed species have any foundation in nature, they are, in all probability, referable to *Zapus hudsonius*; but I doubt that the "long-tailed", "short-tailed", "lion-tailed", "shrew-like", and "big-eyed" *Gerbilli* of M. Rafinesque are aught else than mere figments. This writer is also said to have renamed Davies's animal under the style of *Gerbillus daviesii*, while he is entitled to the credit of leading American authors in giving the specific term *hudsonius* its rightful priority.

In 1865, Professor Giebel† gave some account of the osteology of the animal, the dentition of which had before been specially treated by Fr. Cuvier (*l. s. c.*). In 1872, the habits of the species were made the subject of a special paper by Prof. Sanborn Tenney‡. For additional information respecting its habits, reference may be made to the writings of Audubon and Bachman, DeKay, Samuels, and Kennicott (*ll. ss. cc.*).

\* Notice of the species of *Meriones* and *Arvicola* found in Nova Scotia. < Edinburgh New Philosophical Journal, new series, iii, 1856, p. 1.

† Zur Osteologie des labradorischen Springers, *Jaculus labradorius*. < Zeitschr. gesamm. Naturw. xv, 1865, pp. 272-274.

‡ Hibernation of the Jumping Mouse. < American Naturalist, vi, 1872, pp. 330-332, fig. 101.





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MONOGRAPHS  
OF  
NORTH AMERICAN RODENTIA.

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No. VIII.—SACCOMYIDÆ.

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By ELLIOTT COUES.

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## LETTER OF TRANSMITTAL.

OFFICE OF U. S. GEOLOGICAL  
AND GEOGRAPHICAL SURVEY OF THE TERRITORIES,  
*Washington, D. C., December 1, 1876.*

SIR: I have the honor to transmit herewith, for publication as one of the series of Monographs of North American Rodentia, a memoir upon the family *Saccomyidae*.

This article is based upon the material contained in the National Museum, Smithsonian Institution, including all the specimens collected by yourself, or by the naturalists of the Survey under your direction. It is reproduced, with additions and other modifications, from my paper entitled "A Critical Review of the North American *Saccomyidae*", published in the Proceedings of the Philadelphia Academy of Natural Sciences for 1875, pp. 272-327.

I am, Sir, &c.,

ELLIOTT COUES,

*Assistant Surgeon U. S. A., Secretary of the Survey.*

Prof. F. V. HAYDEN,

*U. S. Geologist-in-charge, &c., &c.*



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## FAMILY SACCOMYIDÆ.

### PRELIMINARY CONSIDERATIONS.

The family *Saccomyidæ*, as understood and defined in this article, consists of the genera *Dipodomys*, *Cricetodipus*, *Perognathus*, *Heteromys*, and "*Sacomys*."<sup>\*</sup> The animals composing the family are confined, as far as now known, to North and Middle America and the West Indies. They may be immediately recognized by the possession of ample *external* cheek-pouches, lined with furry integument, and opening outside the mouth, taken in connection with a general Murine aspect; for the *Geomyidæ*, which are the only other Rodents known to possess such cheek-pouches, are entirely different in external appearance.

<sup>\*</sup> The genus *Sacomys* of Fr. Cuvier was probably based upon a species of *Heteromys*, and is therefore likely to prove to be a synonym of the latter, as Dr. Peters has endeavored to show. (See Monatsb. Akad. Berlin, 1874, pp. 354-359.) The genus *Abromys* of Gray (Proc. Zool. Soc. 1868, 909) is not included in the above enumeration, as it is not recognizable. It is doubtless equivalent to *Perognathus*. (See this memoir, beyond.)

In the valuable paper to which allusion has just been made ("Über die Taschenmäuse, Nager mit kussenen taschenförmigen Backentaschen, und eine neue Art derselben, *Heteromys adspersus*, aus Panama". < Monatsb. k. k. preuss. Akad. Wiss. Berlin, Mai 1874, 88. 354-359, mit Taf.), Hr. W. Peters remarks (p. 356) respecting *Sacomys* as follows:—

"Von diesen beiden letzteren [Gattungen *Heteromys*, *Sacomys*] ist die Gattung *Sacomys* nach einem einzigen ganz jungen Exemplar aufgestellt, welches sich von den bisher bekannten Arten der Gattung *Heteromys* durch den Mangel platter Stachelborsten und eine etwas verschiedene Schnauzenbildung der Backsilbne auszeichnet. Nach einer genauen Vergleichung der Cuvier'schen Abhandlung über *Sacomys* bin ich indess zu der Überzeugung gekommen, dass diese beiden Merkmale in diesem Falle nicht hinreichend sind, um die Aufstellung einer besonderen Gattung zu rechtfertigen. Denn 1. bemerkt man auch bei anderen Nagern, die im reiferen Alter mit Stachelborsten versehen sind, dass diese bei ganz jungen Thieren noch nicht zum Vorschein kommen, und 2. ist die Verschiedenheit der Schnauzenbildung der Backsilbne zwischen *Sacomys* und *Heteromys* nicht grösser als bei Individuen verschiedenen Alters derselben Art anderer Nager, z. B. von *Myoxas glis* und *Spalax typhlus*. Ich bin daher der Meinung, dass *Sacomys* mit *Heteromys* zu vereinigen sei." And, respecting the questionable habitat of the species *S. anthophilus*, the writer adds, in a foot-note:—"Bekanntlich gründete Fr. Cuvier seine Annahme, dass *Sacomys anthophilus* nordamerikanisch sei, darauf, dass Kunth in den Backentaschen seines Exemplars Blüthenreste von *Scorridaea* L. fand. Hr. Prof. Braun hat mir indessen gütigst mitgetheilt, dass die meisten Arten der Polygalen-Gattung *Scorridaea* L. Brasilien und Columbien, einige Westindien angehören, eine Art aus Mexico angeführt sei. Dieses spricht daher dafür, dass das Vaterland von *Sacomys anthophilus* von dem der bisher bekannten Arten von *Heteromys* nicht verschieden sei."



A group *Sacomyina*,\* under a family *Muride*, was established in 1848 by G. R. Waterhouse to contain all those American Rodents which have external cheek-pouches, and consequently included the genera *Geomys* and *Thomomys*, as well as those just specified. Such comprehensive acceptance of the group as a family was endorsed by Baird in 1857,† and more recently by Mr. E. R. Alston.‡ These authors agree, furthermore, in dividing the *Sacomyidae*, as understood by Waterhouse, into two subfamilies; Professor Baird's groups being *Sacomyinae* + *Geomyinae* = *Sacomyidae*, while Mr. Alston, with unnecessary § change of nomenclature, makes *Geomyinae* + *Heteromyinae* = *Geomyidae*. Thus a nominal disagreement is brought about, when really these two authors are at one, both in their valuation and their definition of the groups in question.||

I accept the groups as originally indicated by Waterhouse, and as limited by Baird and Alston, but I differ in my valuation of them, considering that

\* "*Sacomyina*"—a name informally proposed in the text, p. 8, vol. ii, of the Nat. Hist. Mamm. (1848), as the "provisional" designation of a group of no assigned valuation, with the following definition in a foot-note:—

"A group of Rodents found in North, and Central America, and in some of the West India Islands; all the species of which possess cheek-pouches, opening externally; they have  $\frac{1}{2}$  molar teeth. In some the teeth are rootless, and the tail is short; they constitute the genus *Geomys*; in others the tail is long, and the molars are rooted, as in the genus *Heteromys*, *Sacomys*, and *Perognathus*. *Dipodomys* no doubt also belongs to this section, which I provisionally form for genera which there appear to be good reasons thus to unite." (See also K. Johnston's ed. of Berhaus's Physical Atlas, Table of the Orders Rodentia and Ruminantia, No. 5, folio, Edinburgh, 1849.)

In his earlier papers, Waterhouse had placed *Geomys* among true Murine forms in a "family" *Arvicolidae*. See "Observations on the Rodentia, with a view to point out the groups, as indicated by the structure of the Crania, in this order of Mammals." < *Charleav. Mag.* N. H. viii, 1839, pp. 90-98, 184-188, 274-279, 593-600; wood-cuts. (See also *Ann. Mag. Nat. Hist.* viii, 1841, pp. 81-84; x, 1842, pp. 197-203, 344-347; and P. Z. S. 1839, pp. 172-174.)

† *Mammals of North America*, p. 365 (4to, Washington, 1857).

‡ On the Classification of the Order Glires. < *Proc. Zool. Soc. Lond.*, Jan. 1876, pp. 61-98, pl. iv (See especially pp. 69 and 87.) A paper no student of the Rodentia should fail to consult.

§ I cannot agree with Mr. Alston that, because Fré. Cuvier's genus *Sacomys* is doubtless a synonym of *Heteromys* Desm., it is in consequence necessary to derive the name of the subfamily from the latter, and speak of *Heteromyinae* instead of *Sacomyinae*. It is always admissible to derive the name of a subfamily or family from any one of its component genera, though, of course, desirable that such a name should indicate a characteristic or otherwise leading generic type. Hence, though *Sacomys* is an undoubted synonym, it is not necessary to discard the terms *Sacomyinae* and *Sacomyidae*, long established and in general employ, as well as suggestive and pertinent.

|| Brandt, perhaps alone among late leading writers, dissents from the views here implied. "In his recent paper on the classification of the Rodentia in *Beiträge zur näheren Kenntniss der Säugethiere Russlands*, 1855, 188, [he] establishes a family of *Sciuro-spalcoides* to contain *Geomys* and *Thomomys*; as constituting a connecting link between the *Sciuridae* and a family of *Spalcoides*, typified by *Spalax*, *Sipkensis*, *Ellobius*, &c. He dissents from the views of Waterhouse in combining *Geomys* and *Thomomys* into a family with *Perognathus* and *Dipodomys*. *Perognathus* he considers rather as a Murroid, and coming next to *Cricetus*, while *Dipodomys*, or rather *Macrocoelus*, is placed as the type of a sub-family *Macrocolini* under the *Dipodoides*. I think, however, a revision of the subject, with more ample materials before him, will satisfy this eminent zoologist of the soundness of Waterhouse's view."—(Quoted from Baird, M. N. A., pp. 365-6, as pertinent to the history of the subject, and as a statement in which I fully concur.)

each should rank as a family; for, as I have already attempted to show,\* the great difference in configuration between the *Geomyidæ* and *Sacomyidæ*, though only a matter of secondary consequence, is coördinated with structural characters important enough to warrant the erection of the subfamily *Sacomyinae* into a family *Sacomyidæ*, distinct from, though unquestionably standing next to, the family *Geomyidæ*.

It may be conceded that this valuation was virtually, if only incidentally, set forth in 1868 by Dr. J. E. Gray,† who, though using a terminology ("*Sacomyinae*") indicative of a subfamily, nevertheless speaks of "the family" of Pouched Mice, from which *Geomys* and *Thomomys* are excluded.

In 1872, Dr. T. Gill‡ first formally recorded a family *Sacomyidæ* as equivalent to the subfamily *Sacomyinae* of Baird, 1857, and of Gray, 1868, and to the subsequent *Heteromyinae* of Alston, 1876. The group thus accorded full family rank was placed next to the family *Geomyidæ*, the two together constituting one of the author's numerous taxonomic refinements, a "super-family" (or series) *Sacomyoidea*, which was hence exactly equivalent to the group *Sacomyina* as founded by Waterhouse and the family *Sacomyidæ* as endorsed by Baird. Such term, *Sacomyoidea*, may be accepted as an expression of the unquestionable fact that the *Sacomyidæ* and the *Geomyidæ* are more intimately related to each other than they are to any other family of the Rodents.

Thus following Professor Gill in determining a family *Sacomyidæ* so drawn as to exclude *Geomyidæ*, I wish, before giving my characterization of the group, to note what disposition has been made of its component genera by several authors. Dr. LeConte, in 1853,§ and Professor Baird, in 1857,|| both treated only of North American forms, recognizing but two genera, *Dipodomys* and *Perognathus* (+ subg. *Cricetodipus*). Dr. Gill made no subdivision of the family. Mr. Alston recognized three genera,—*Dipodomys*, *Perognathus* and *Heteromys*. Dr. Gray, and, following him, Hr. Peters,\*\* divided the Pocket Mice into two groups of no assigned value, namely,

\* Bulletin U. S. Geol. and Geogr. Surv. Terr. 2d ser. No. 9, 1875, pp. 83 seq.; and Proc. Acad. Phila. 1876, pp. 272 seq.

† Synopsis of the Species of *Sacomyinae*, or Pouched Mice, in the Collection of the British Museum. < Proc. Zool. Soc. Lond. 1868, pp. 199-206.

‡ Arrangement of the Families of Mammals. With Analytical Tables. Prepared for the Smithsonian Institution. < Smiths. Misc. Coll. No. 230. (Svo, Washington, 1872.)

§ Remarks on the Genus *Dipodomys* and *Perognathus*. < Proc. Phila. Acad. vi, 1853, pp. 224, 225

|| Mammals of North America, pp. 406-496. 1857.

\*\* Monatsb. königl. preuss. Akad. Wissensch. Berlin, Mai 1874, p. 355.

*Dipodomys*, with *Dipodomys* alone, and *Heteromys*, including all the rest of the genera; the *Heteromys* of these authors being further subdivided into those with sulcate upper incisors (*Perognathus*, "*Abromys*", and *Cricetodipus*) and those which have smooth upper front teeth (*Heteromys* and "*Sacomys*"). As the former author drew up his characters, excepting those of the front teeth, from trivial superficialities which may be observed upon inspection of stuffed skins, I am unable to gain, from his remarks, any satisfactory idea respecting the degree of relationship which subsists between the North American *Perognathus* and *Cricetodipus* on the one hand, and the Neotropical *Heteromys* on the other.

Dr. Peters's excellent characterization, which is quoted at length beyond, is much more satisfactory. My impression is, however, that characters of more than generic value will be found to distinguish these genera.\* However the case may stand respecting *Heteromys* and "*Sacomys*",† it is demonstrable that the genus *Dipodomys* is isolated from the rest by its exaggerated cranial peculiarities and other less extraordinary characters. This enables us to throw the North American genera into two subfamilies, easily characterized; one containing *Dipodomys* alone, the other embracing *Perognathus* and *Cricetodipus*. The characters are tabulated beyond.

In these preliminary remarks respecting the valuation, definition, and subdivision of the group of Pouched Mice here to be treated, I wish, for the rest, to insist upon full generic distinction between *Perognathus* and *Cricetodipus*. The latter was first satisfactorily characterized by Professor Baird as

\* Mr. Alston distinguishes them as genera, with the following characters:—

*Perognathus*.—"Ears shorter [than in *Dipodomys*, to which other comparative expressions also refer]; tail thinly haired; soles more or less naked; pollex with a flat nail. Skull less modified; nasals not so much produced; zygoma not developed into a flat plate; interparietal broad; auditory bullae not projecting behind the occipital plane. Incisors grooved. Grinding-teeth rooted, tuberculate in youth, afterward with isolated enamel-loops."

*Heteromys*.—"Like *Perognathus*, but the fur bristly, mixed with flattened spines; tail shorter, clad with large scales and scattered hairs. Skull with sharp supraorbital ridges; interparietal very broad. Upper incisors plain. Grinding-teeth as in *Perognathus*."—(P. Z. S. 1876, 88.)

† "*Sacomys*" is a genus which is said to have been proposed in 1833 by Fréd. Cuvier ("Description du *Sacomys anthophile*. < Mém. du Muséum d'Hist. Nat. x, 1833, pp. 419-428 ") for an animal supposed to be from the warm portion of America. The original account I have not been able to consult; as described by the same author in 1825 (*Dents des Mammifères*, etc., p. 186, no. and pl. 74, figs. a, b), the animal is said to have the "taille du lérôt" and "abajones extérieures", the dental formula is given as i.  $\frac{3}{1}$ , pm. and m.  $\frac{4}{1}$ , and the teeth are fully described and figured, but no further information upon the structure of the animal is given. The species is not even named formally, naturalists being left to infer a "*Sacomys anthophile*" from an expression used on p. 187, where "le nom d'*anthophile*" is bestowed from the circumstance that the pouches of the specimen examined were filled with flowers. Mention of the external cheek-pouches, however, together with the account of the teeth, renders it no less than certain that the genus is a member of the present group; and, as already stated, there is no doubt that it is a synonym of *Heteromys*. (See what Mr. Peters says, as quoted in a foregoing foot-note, p. 487.)

a subgenus of *Perognathus*, upon certain obvious and eligible external characters alone. But examination of the skull, which, it seems, that author did not make, has satisfied me that the cranial peculiarities are fully up to a current generic mark. *Cricetodipus*, in fact, makes a decided step away from *Perognathus* in the direction of *Dipodomys*, though still falling far short of the exaggerated peculiarities of the latter.

### FAMILY SACCOMYIDÆ.

- < *Sacomys*, WATERHOUSE, Nat. Hist. Mamm. ii, 1848, 8. (As a group of *Murida*. Included the *Geomyia*, now made a separate family; equivalent to the "superfamily" *Sacomysoides* of Gill, 1872.)
- < *Pseudostomida*, GERVAIN, "Diet. Univ. d'Hist. Nat. xi, 1848." (Family. Equivalent to the *Sacomys* of Waterhouse.)
- < *Sacomys*, LILLJEBORG, Syst. Cefv. Gnag. Däggdj. 1866. (Family. Equivalent to *Sacomys* of Waterhouse.)
- = *Sacomys*, BAIRD, Mamm. N. Am. 1857, 404. (Subfamily of *Sacomys*, which, with this author, included *Geomyia*, Baird's family *Sacomys* being equivalent to *Sacomys*, Waterh.)
- = *Sacomys*, GRAY, Proc. Zool. Soc. 1868, 199. (Spoken of as a "family", though terminology indicates subfamily.)
- = *Sacomys*, GILL, Arrang. Fam. Mamm. 1872, 91. (Family.)
- = *Sacomys*, COUES, Proc. Phila. Acad. 1875, 274. (Family.)
- = *Heteromys*, ALSTON, Proc. Zool. Soc. Lond. 1876, 88. (Subfamily. Equivalent to *Sacomys* of Baird and *Sacomys* of Gill and Coues.)

**CHARS.\***—Skull light, thin, and papery, with few, if any, decided angles or ridges; rostrum elongate, attenuate, and tapering; nasals projected beyond incisors. Intermastoid width not less than the interzygomatic, sometimes much greater. Interorbital space much wider than the rostrum. Occipital region formed largely or mostly of the mastoids. Palatal surface nearly flat and horizontal. No anteorbital foramen in a usual site, but a large, rounded perforation of the side of the maxillary instead. Zygomata slender, depressed in position, almost or quite abutting behind against the tympanic; malar thread-like. A delicate scroll-like lachrymal, easily detached. Frontal broadly trapezoidal. Parietal broad, triangular or pentagonal. A large interparietal, embraced betwixt forks of the occipital. Squamosal almost entirely restricted to the orbit. Tympanic more or less inflated. Mastoid enormously enlarged and bulbous, mounting to the top of the skull, and also forming much or most of the occipital surface, the occipital bone itself being correspondingly reduced, and scarcely forming part of the general occipital surface. Petrosals moderately inflated, their apices closely approximated or even in mutual contact. Coronoid process of mandible slender, sloping, prickly-like, scarcely

\*Drawn from *Perognathus*, *Cricetodipus*, and *Dipodomys*; but there is reason to believe that no material modification of the phrase is required to embrace *Heteromys*—excepting probably some of the cranial features, especially those of the temporal region. Special reference is had to antithesis with *Geomyia*.

or not attaining top of condyle; mandible small and weak in comparison with rest of skull. Cervical vertebræ\* sometimes ankylosed. Incisors variable (the upper compressed and sulcate in North American genera, said to be broad and smooth in *Heteromys*). Molars (i. e. pm. and m.)  $\frac{1}{2}$ - $\frac{3}{4}$ , rooted or rootless. General form Murine; body slender and graceful; ears and eyes well developed. Hind limbs somewhat or very decidedly saltatorial. Tail as long as the body (more or less). Fore claws moderate, not obviously fossorial. External cheek-pouches ample, not connected with the mouth, furry inside, furnished with a special muscle (these pouches as in *Geomyidæ*, but no other Rodents). Pelage generally coarse and hispid, said to be sometimes mixed with flattened spines (in *Heteromys*); always without under fur. The species very active and quick in their movements, like Mice; some of them leaping like Jerboas.

The foregoing characters amply suffice for the determination of this family, though others might be adduced. The skull is very peculiar; its main features result from the exaggerated state of the mastoids, which produce great width behind, roof much of the cerebral cavity, pinch the occipital, and push the squamosal into the orbit. The next most prominent features are the slight thread-like malar, attenuated rostrum, and flat palate. The curious position of the anteorbital foramen is shared by the *Geomyidæ*. To bring the comparative characters of *Sacomysidæ* and *Geomyidæ* into stronger relief, the following may be adduced:—

## GEOMYIDÆ.

(Geomys and Thomomys.)

Skull massive, angular, in general of an Arvicoline superficialities.  
Interorbital constriction narrower than rostrum.  
Interzygomatic width the greatest diameter of the skull.  
Palate strongly sloping downward far below level of zygomatica.  
Nasals not produced beyond incisors; rostrum broad, blunt, parallel-sided.  
Zygomatica strong, flaring, with stout, short malar, having ordinary connections.  
Frontal compressed.  
Parietals compressed, irregularly linear, remote from orbits.

## SACCOMYIDÆ.

(Perognathus, Cricetodipus, Dipodomys.)

Skull delicate, with rounded-off angles and slight ridges, if any.  
Interorbital space much broader than rostrum.  
Intermastoid width the greatest diameter of the skull.  
Palate nearly horizontal, little, if any, below the level of zygomatica.  
Nasals produced beyond incisors; rostrum compressed, tapering, acute.  
Zygomatica slender, parallel, with long thread-like malar, almost or actually abutting against tympanic.  
Frontal very broad.  
Parietals broad, triangular or pentangular, coming to edge of orbits.

\* There is a curious coincidence or correlation between the elongation of the hind legs in adaptation to saltatorial progression, and a special condition of the cervical vertebræ and of certain elements of the temporal bone, such development of the hind legs being often associated with ankylosis of cervical vertebræ, and great inflation of the bones of the ear. *Dipus* and *Dipodomys* illustrate these conditions very strongly.

## GEOMYIDÆ.

*(Geomys and Thomomys.)*

Squamosals roofing most of cerebral cavity, from roof of which mastoids are excluded.  
 Tympanics contracted, tubular.  
 Petrosals widely discrete.

Occipital broad, forming most of occipital plane, but not mounting on top of skull.

Molars rootless.  
 Large, erect, falcate coronoid overtopping condyle.  
 Lower jaw large and strong.  
 General form heavy, squat, clammy—Arvicoline.  
 Fore limbs highly fossorial; the claws much enlarged, fitted for digging.  
 Eyes and ears minute.  
 Tail much shorter than body.  
 Pelage usually soft, lustrous, mole-like.  
 Habits completely subterranean.

## SACCOMYIDÆ.

*(Perognathus, Cricetodipus, Dipodomys.)*

Squamosals mostly or wholly restricted to the orbits; mastoids roofing much of cerebral cavity.  
 Tympanics more or less inflated, vestibular.  
 Petrosals approximating or in actual contact at their apices.

Occipital contracted, scarcely or not entering occipital plane, but mounting top of skull, to there embrace interparietal between its forks.

Molars rooted (except in *Dipodomys*).  
 Small, aloping, prickle-like coronoid below condyle.  
 Lower jaw small and weak.  
 General form light, lithe, and graceful—Murine.  
 Hind limbs more or less saltatorial. Fore claws not enlarged or specially fossorial.  
 Eyes and ears large.  
 Tail nearly as long as or longer than body.  
 Pelage usually coarse and hispid, even spiny.  
 Habits exposed.

I may next illustrate the points of resemblance between *Sacomys* and *Geomys* as distinguished from other Rodents, thereby showing the characters of the "superfamily" *Sacomyoidea* as named, but not defined, by Gill—the former family *Sacomys* of Baird, group *Sacomys* of Waterhouse.

SACCOMYIDÆ and GEOMYIDÆ = SACCOMYOIDEA.—Mastoid bone inordinately developed, occupying much of the occipital or superior surface of the skull, or both. Occipital correspondingly reduced. No postorbital processes; no anteorbital foramen as such,—in its stead a perforation in the side of the maxillary far forward and low down. Zygomatic process of maxillary an expanded perforate plate. Molars (pm. and m.) 4. Root of under incisor more or less protuberant posteriorly. Descending process of mandible an obliquely twisted plate, projecting outward and upward. Large external furred cheek-pouches with special muscle; upper lip densely hairy, not visibly cleft; feet pentadactyle; fore claws longer than hinder ones. Pelage without under fur.

It will be observed that the differences outweigh the resemblances, notwithstanding the higher taxonomic value of some of the latter. The peculiar state of the temporal bone, the position of the anteorbital foramen, the shape of the jaw, and the presence of the pouches, are the main common characters. In contrasting the two families, the very peculiar genus *Dipodomys* offers the strongest points of difference; but, when we come to consider *Perognathus* and *Cricetodipus*, many of the expressions applicable to *Dipodo-*

*mys* require modification. *Perognathus* is a link between the two families, just as, in its own family, *Cricetodipus* is between *Perognathus* on the one hand, and the extraordinarily modified *Dipodomys* on the other.

This brings us to the consideration of what, if any, division may be made of the family *Sacomys* into groups of more than generic value. The genus *Dipodomys* is so exaggerated in some of its peculiarities that, as it seems to me, its characters may properly be set over against those which *Perognathus* and *Cricetodipus* share together. The leading antitheses may be indicated in the following manner:—

## Subfamily PEROGNATHIDINÆ.

(Perognathus and Cricetodipus.)

Cervical vertebra free (†).  
Molars rooted.  
Anterior molar with a lobe in addition to the main prism.  
Skull half as wide as long, and two-thirds as high as wide.  
Mastoids moderately developed (for this family).  
Tympanic little inflated.  
Occipital plane not, or not much, emarginate.  
Petrosals, though approximate, not in contact with each other, but with basi-occipital throughout.  
Zygomatic plate of maxillary of ordinary Rodent character.  
Parietals pentagonal.  
Interparietal wider than long.  
No pit on inner side of lower jaw near the molars.  
Hind limbs little if any longer than the fore, not very obviously saltatorial.  
Inner hind digit well developed and low down.  
Soles naked or sparsely pilous.  
Pelage comparatively coarse and harsh.

## Subfamily DIPODOMYINÆ.

(Dipodomys alone.)

2d, 3d, and 4th cervical vertebrae ankylosed.  
Molars rootless.  
Anterior molar a simple prism.  
Skull two-thirds as wide as long, and half as high as wide.  
Mastoids extraordinarily developed (even for this family).  
Tympanic completely bullous.  
Occipital plane deeply emarginate.  
Petrosals in mutual contact at their apices, and fissured away from basi-occipital.  
Zygomatic plate of maxillary roofing much of the orbit.  
Parietals triangular.  
Interparietal longer than wide.  
A deep pit on inner side of lower jaw near the molars.  
Hind limbs elongated, Jerboa-like, highly saltatorial.  
Inner hind digit rudimentary and elevated.  
Soles densely hairy, like a rabbit's.  
Pelage comparatively soft (for this family).~

Having never seen a specimen of *Heteromys*, I am unable to say how nearly this genus may coincide with the characters of *Perognathidina* as here established; Mr. Alston\* seems to consider it closely related to *Perognathus*; so does Hr. Peters;† but it is my impression that it will prove to constitute

\* See his characters of these genera, as quoted in foot-note on a foregoing (page 490.)

† Hr. W. Peters (loc. supra cit. p. 355), endorsing Waterhouse's and Baird's views of the constitution of the group, proposes to divide it as follows:—

a. *Dipodomys*, with rootless molars, grooved upper incisors, and no spines in the pelage.

*Dipodomys* Gray = *Macrocolus* Wagner.

b. *Heteromys*, with rooted molars.

† Upper incisors grooved.

*Perognathus* Maxim. and the subgenera *Abronyx* Gray and *Cricetodipus* Peale.

†† Upper incisors broad and smooth in front.

*Heteromys* Desmarest and *Sacomys* Fr. Cuv.

In characterizing his new species of *Heteromys*, *H. adspersus*, Hr. Peters gives (loc. supra cit. pp.



a third subfamily. In such case, some few of the characters of the three would be as follows:—

**DIPDOMYINÆ.**—Molars rootless; upper incisors compressed, sulcate. Temporal region enormously inflated. Pelage comparatively soft.

**PEROGNATHIDINÆ.**—Molars rooted; upper incisors compressed, sulcate. Temporal region moderately inflated. Pelage comparatively hispid.

**HETEROMYINÆ.**—Molars rooted; upper incisors broad, smooth. Temporal region "not inflated". Pelage "mixed with flattened spines".

#### SUBFAMILY PEROGNATHIDINÆ.

= *Perogethus* (genus), of AUTHORS.

= *Perogethinæ*, COUES, Proc. Phila. Acad. 1875, 278.

The characters of the group having been already sufficiently elucidated, it remains to note the two genera by which it is represented in North Amer-

357-359) a more satisfactory account of the characters of the genus than I have seen elsewhere. As this account furnishes important information pertinent to the general subject, I transcribe his diagnosis of the genus, and give a version of those portions of the description of the species which tend to further elucidate the generic characters.

"*Dentes incisivi pagina antica laevigati exserti, molares  $\frac{4}{4}$  complicati radicati; labrum integrum; rictus parvus; rostrum prominens, rhinario nudo; sacculi buccales externi pilosi; auriculæ mediocres; velæ setosæ, setis lanceolatis, cauculicatis; pedes pentadactyli; cauda annulata, brevipilosa. Os interparietale latum, tempora non inflata.*"

"*Habitus of Mus.* Thumb prominent, with rounded nail, shorter than the other digits, which run 5th, 3d, 4th, and 3d, the latter longest. Relative lengths of the digits of the hind foot as in *Geomys*; 5th but little longer than 1st, 3d longest; claws rather longer than those of the fore foot, that of the 2d toe longest, convex on the inner side, flat on the outer. Soles naked, with the usual tubercles. Incisors compressed, the horizontal cross-section triangular, with rounded hinder angle, and apparently broader than long. Molar series parallel; last molar in each jaw smallest; 2d and 3d upper molars of equal size and notably smaller than the 1st; anterior molar of lower jaw but little larger than the next two . . . .

"Incisors yellow, the lower paler colored than the upper. Anterior superior molar with three separate enamel-tubes—an anterior, longer and narrower, a posterior shorter and broader, and a third much smaller oval one on the inner side of the tooth in a recess where the other two stand apart; second upper molar with a deep internal and slight external emargination, or fold of enamel; third with a slight exterior emargination, which is either continuous with a transversely-elliptical interior island of enamel, thus forming a deep enamel-fold, or else only just reaches this island without fusing with it; back upper molar with the enamel-pattern like that of the second one, but the posterior half of the tooth considerably smaller than the anterior portion.

"Anterior inferior molar with two enamel-tubes, the anterior of which, somewhat smaller than the other, is emarginate before and behind; the three following teeth with a deep inner and slight outer emargination, as on the upper teeth, which are either separated or fused together, in which latter case two separate enamel-tubes result.

"The rostral portion of the skull is narrow; the nasal bones and intermaxillaries project beyond the incisors as in allied genera, and the intermaxillaries form anteriorly a sharp perpendicular ridge. The structure of the small incisive foramina, the shape of the lachrymal bones and infraorbital foramina are quite as in *Geomys*. The latter are wholly in the superior maxillary and are separate from the nasal cavity. Since, however, the bony septum is in this case extremely thin, and easily mutilated, the deceptive appearance of communication between the infraorbital foramina and the nasal passages may be accidentally produced. The frontal bone, as in *Mus*, forms a sharp supraorbital ridge, which continues on to the parietal, thus forming with its fellow of the opposite side the boundary of a level area, with which the interparietal, twice as broad as long, is posteriorly continuous, whilst the temporal fossa is excavated [a strong character of *Heteromyina*—there is no such formation in *Perogethinæ*.—Tr.]. The lower jaw strongly resembles that of *Perogethus* in the form of the coronoid process and mandibular angle; the deep pit which is found in *Geomys* to the outer side of the posterior molar is here wanting."



ica. These may be readily distinguished by much stronger characters than any hitherto adduced by other writers:—

Genus *Perognathus*.

Occiput nearly plane, *i. e.*, the mastoids not projecting noticeably back of the occipital bone.

Apices of petrosals separated by the whole width of the basisphenoid.

Parietals perfectly pentagonal, with nearly equal sides.

Interparietal elliptical, much broader than long, embraced between narrow plates of occipital.

Ear with a distinct upright lobe of the antitragus, and generally also a lobe of the tragus.

Sole naked to the heel, at least along a central stripe.

Size of *Mus musculus*, or much larger.

Genus *Cricetodipus*.

Occiput with a broad emargination, *i. e.*, the mastoids bulging decidedly back of the occipital bone.

Apices of petrosals almost meeting beneath the basisphenoid.

Parietals imperfectly pentagonal, inequilateral.

Interparietal pentagonal, shield-shaped, embraced between mere spurs of the occipital.

Ear with no vestige of a lobe either of antitragus or tragus.

Sole entirely hairy on the posterior half.

Very diminutive; less in size than *Mus musculus*.

The cranial characters above adduced, it may be observed, are all coördinated with the single main feature of much greater development of the mastoid in *Cricetodipus* than in *Perognathus*, the state of the parts in the former being an evident approach to the peculiarities of *Dipodomys* itself. The difference in the shape of the occiput is very striking when skulls of the two genera are laid beside each other; the part in *Perognathus* being quite flat, as in most Rodents, while *Cricetodipus* shows an emargination, much shallower and comparatively much broader than in *Dipodomys* indeed, but still well-marked. These cranial peculiarities, substantiating a genus *Cricetodipus* distinct from *Perognathus*, do not appear to have been noted before the appearance of my "Review". They are correlated with the excellent and readily appreciable external characters of the feet and ears presented by Professor Baird.

GENUS PEROGNATHUS, Maxim.

= *Perognathus*, MAXIM., Nov. Act. Acad. Cæs.-Leop. Carol. xix, 1839, 360. (Type *P. fasciatus*.)—COUES, Proc. Phila. Acad. 1875, 279. (Excludes *Cricetodipus*.)

< *Perognathus*, LeCONTE, Proc. Acad. Nat. Sci. Phila. 1863, 224. (Includes *Cricetodipus*.)—BAIRD, Mamm. N. A. 1857, 416. (Includes *Cricetodipus*.)—ALSTON, Proc. Zool. Soc. Lond. 1876, 88. (Includes *Cricetodipus*.)

= *Abromys*,\* GRAY, Proc. Zool. Soc. Lond. 1868, 202. (Type "*A. lordi*", sp. n. = *P. monticola*.)

Having already indicated the generic characters of *Perognathus*, I need only here give some further details respecting the skull and teeth, following with

\* Auct. E. B. Alston, epist. ined. Londini, 25 Nov. 1876.—In penning my original account of this group for Proc. Phila. Acad., I was at a loss to know what to do with *Abromys*; so I simply copied Gray's notice into my text, stating that I could not make it out at all, though I failed to see any difference between "*Abromys*" and *Perognathus*, and suspected "*A. lordi*" to be *P. monticola*. In this impression, it seems, I

an analysis of the species. I have before me skulls of all the known valid North American species excepting *P. fuscatus*. They are so nearly similar that description of one will suffice for all, barring some slight ultimate details of size, &c. I select that of *P. penicillatus* for description, omitting generalities already presented. The description may be compared with that of *Dipodomys* given beyond.

Although the temporal bone is largely developed in the mastoid element, that lacks the enormous inflation seen in *Dipodomys*, the general shape of the skull being not dissimilar to that of several allied Rodents. Nevertheless, the mastoid represents the postero-exterior aspect of the skull, and is large enough to crowd the squamosal into the orbit, causing a slight protuberance beyond the actual plane of the occipital bone. But this is insufficient to produce even the moderate emargination of this surface witnessed in *Crice-todipus*, and is nothing at all like the regular cleft or chink seen in *Dipodomys*. The ends of the petrosals are fairly separated by the width of the basisphenoid; they lie in contact throughout with the basioccipital, and show a conspicuous foramen posteriorly on the inner side. The meatus auditorius appears as a mere flange-like projection, intermediate in character between the swollen vestibule of *Dipodomys* and the contracted tube of *Geomyidæ*, though nearest the latter. The occipital is broader than in any other genus of the family; the forks which embrace the interparietal being fairly laminæ, instead of mere linear spurs. The interparietal is much wider than long. The parietals are almost perfectly pentangular. A slight spur of the squamosal pushes out toward the meatus, but does not extend as a long clasp over the tympanic;\* the squamosal is otherwise wholly orbital. The frontal is quite flat on top, squarely and straightly truncate behind, serrate in front for

was right. I quote from Mr. Alston's letter some passages which bear upon the case, and show, furthermore, with what caution must not Dr. Gray's statements be received:—"The type of *Abromys lordi* is in bad condition, the ears being hopelessly distorted, but it seems to me to be undoubtedly *P. monticola*. *P. bicolor* Gray, (from Honduras,) appears to be a good species, but has been curiously badly described. It is dark brown above, not black, and tho' the fur is sparse and somewhat harsh, it is not in the least bristly! Gray seems to have had both this specimen and his *Heteromys melanoleucus* in his hands when he wrote and to have confused one with the other. *H. demarettianus* Gr. and *H. adspersus* Ptm. will prove, I fancy, to be identical. . . . Dr. Günther has lately got a perfect spirit-specimen of *H. aumeles* Thomps., so we may expect a full account of its anatomy. As you surmised, Gray's four other species, *H. melanoleucus*, *longicaudatus*, *trivertatus*, and *albimaculatus*, seem to belong to one rather variable species."

\* In a specimen of *Crice-todipus*, I clearly see that a long slender spur is sent out from the squamosal, like a clasp or hasp, lying above and reaching back of the meatus. Cf. what is said of an apparently similar, but not well made out, appearance in *Dipodomys*, beyond. It is, in this case, a slender remnant of squamosal bone, left in an ordinary place, after most of the bone has been shoved into the orbit by the encroachment of the mastoid.

articulation with the rostral bones, and with straight sides convergent posteriorly.\* There is a large lachrymal of very irregular shape, extensively scroll-like, very delicate in texture, and loosely attached; it closes a large aperture leading into the nasal chamber. The orbit is also perforated behind by a single very large foramen of exit of cranial nerves. It is bounded in front, but not roofed over, by the zygomatic plate of the maxillary, not noticeable in character. The extremely delicate malar sutures in front for a long distance, clasp-like, against the zygomatic process; behind, it simply abuts against a slight heel of the squamosal, almost in relation with the tympanic. The singularly displaced "antorbital" foramen is a large rounded aperture in the side of the snout, communicating directly with the nasal cavity. The nasal bones are parallel-edged for most of their length, but widen a little and become semitubular anteriorly where they project; they are truncate behind, reaching opposite the middle of the jagged fronto-maxillary suture. The sides of the rostrum are contracted below, leaving a very narrow bridge of bone between molars and incisors; the contracted incisive foramina are bounded behind by the maxillaries, though they are chiefly pierced in the intermaxillaries. The intermolar portion of the palate is longer than wide, and a little convergent anteriorly; the maxillo-palatine suture is opposite the second molar; there is a pair of deep palatal pits opposite the last molars; behind there is a pair of much larger vacuities bounded by palatals in front, sphenoid behind, and pterygoids internally. The latter are simple, straight, nearly parallel processes, bounding the contracted posterior nares, and abutting against the petrosals. The orbital plate of the sphenoid is of moderate extent, owing to the size and site of the squamosal.

The molars in this genus, as in others of the family excepting *Dipodomys*, are all rooted. They have been said to have four roots, but such is not the case in the specimens I have examined. In *P. penicillatus*, all the upper molars have three roots apiece, and all the under molars have two roots apiece, excepting the back upper one, which has but one. The front upper molar has one root in advance, corresponding to the anterior lobe of this tooth, and a pair of roots obliquely side by side behind. The next two upper molars have each an exterior pair of roots, lengthwise, and a larger single root

\*Neither this nor any other North American genus shows the ridge of the frontal, which in *Heteromys*, as figured by Peters, makes a boss, or bead, along the margin of the orbit, and thence extends into the parietal region. This would seem to be a good character of *Heteromyinae*; and the skull of the latter is peculiar in other respects—to judge from Peters's figure.

on the interior side; the back upper molar is simply single-rooted. The under molars have each a pair of roots, aligned lengthwise in a single series, but the two roots of the back lower molar are imperfectly distinguished. With these last exceptions, each root of all the teeth has its own distinct socket in the alveolus.

In the perfectly unworn state, the crowns of the molars are studded with tubercles in regular transverse series. In the upper jaw, the anterior molar has four,—an anterior, a posterior, an exterior, and an interior, with perhaps another one part way up the anterior lobe. The second and third upper molars have each six tubercles, in two straight transverse rows of three each, these rows separated by a deep sulcus. The smaller circular back upper molar tends indistinctly to a similar state. In the lower jaw, the tuberculation is very similar; but the four tubercles of the first molar are in an anterior and posterior pair, and on the last one the tubercles become indistinct. The teeth present a very different aspect when the tubercles are ground off with wear. Each transverse row of tubercles becomes converted into an island of dentine, there being thus, on the intermediate molars at any rate, a pair of such transverse dentine islands separated by a double ridge of enamel partition, between which is the bottom of the sulcus already mentioned. This enamel fold makes in from the outer side of the tooth nearly to the inner side. The front molar shows a little isolated island of dentine anteriorly, nearly circular, and a broad transverse one posteriorly. The state of the under teeth is substantially the same.

The upper incisors are small, compressed, with a strong backward set. Their face is deeply channelled with a longitudinal groove, and the exterior moiety is rabbeted down so that the groove is visible laterally as well as from the front. This is a prominent character (shared by *Cricetodipus* and *Dipodomys*) in distinction from *Heteromys*. The under incisors are small and simple.

Before leaving this portion of the subject, I may as well mention a curious circumstance: the ease with which the skulls of *Perognathus* and *Crice-*



Explanation of figs.—  
Left ear, in each case,  
twice the natural size;  
upper fig. *P. monticola*;  
middle fig. *P. penicillatus*;  
lower fig. *Cricetodipus flavus*.

*todipus* break apart across the middle. This seems to be chiefly due to the delicate state of the zygomata, which afford no stable connection between the fore and aft parts. The break occurs at the basispheno-occipital, squamo-mastoid, and fronto-parietal sutures; the parietals, temporals excepting squamosals, with the occipital, coming away from the rest of the skull.

There appears to be something peculiar, in the habits perhaps, rather than in the scarcity, of the species, which prevents the acquisition of large series of specimens in this family. While hundreds of examples of animals no larger or more conspicuous than these are readily amassed, collections are all deficient in *Perognathus* and *Cricetodipus*, and not very full in *Dipodomys*. I have not been able to examine more than a hundred specimens altogether, and of these more than half were *Dipodomys*. Of *Perognathus*, I have, however, specimens of all the described North American species, including all of Baird's types and considerable additional material. After protracted examination, I endorse the validity of all the species admitted by that author in 1857, and find indications of the probable existence of one or two more. This point is fully discussed beyond. The species that appear to be established may be readily determined by the following analysis:—

*Analysis of the Species of PEROGNATHUS.*

- A. Notch of the ear bounded in front by a slight, though distinct, lobe of the tragus. Whole fore leg white.
- a. Tail penicillate, crested at the end, rather longer than the body and head. Sides with no fulvous stripe ..... *PENICILLATUS.*
- b. Tail simple; sides with a strong fulvous stripe.
1. Tail decidedly shorter than the body and head. Length about 4 inches. Pelage moderately stiff. Mixed sandy and blackish ..... *FASCIATUS.*
2. Tail not shorter than head and body. Length about 3 inches. Pelage very hispid. Mixed cinnamon and blackish ..... *HISPIDUS.*
- B. Notch of ear formed in front directly by the edge of the conch. Fore leg mostly colored like the back.
- Tail simple; lateral stripe obscure ..... *MONTICOLA.*

**PEROGNATHUS FASCIATUS, Maxim.**

*Perognathus fasciatus*, MAXIM., N. Act. Akad. Leop.-Ces. Nat. Cur. xix, pt. i, 1839, 360, pl. 34; Reise Nord-Am. i, 1839, 449; Arch. f. Naturg. 1861, p. —; Verz. Reise, 1862, 175, pl. 4, f. 6, 7.—WAGN., Arch. f. Naturg. 1841, 45; Suppl. Schreb. iii, 1843, 612.—SCHINZ, Syn. Mamm. ii, 1845, 259.—LEC., Proc. Acad. Nat. Sci. Phila. vi, 1853, 294.—AUD. & BACH., Q. N. A. iii, 1854, 341 (compiled).—GIEBEL, Säugeth. 1855, 572 (compiled).—BR., M. N. A. 1857, 421 (Chihuahuas).—BR., U. S. Mex. Bound. Surv. ii, pt. ii, 1859, Mamm. 42.—SUCKL., P. R. R. Rep. xii, pt. ii, 1860, 101 (compiled).—GRAY, P. Z. 3, 1868, 201.—COUES, Proc. Phila. Acad. 1875, 284 (monographic).

*Perognathus fasciatus*, LINCOLN, Am. Nat. vi, 1872, p. 369 (habits).

*Perognathus fasciatus*, LINCOLN, Am. Sportsman, Feb. 23, 1874 (habits).

**DIAGNOSIS.**—Largest of the genus; considerably exceeding *Hesperomys leucopus*, and approaching *Tomias quadrivittatus*, in size; length four inches

or more; tail less; hind foot about one inch. Tail decidedly shorter than head and body, not penicillate. Ears large; antitragus distinctly lobed. Soles naked to the heels,—at least along a median strip. Above, reddish-yellow, closely lined with blackish; below, including fore leg all around, white; the two colors separated by a conspicuous stripe of fawn-color or salmon-red running the whole length of the body; tail distinctly bicolor.

HABITAT.—United States, west of the Mississippi and east of the Rocky Mountains, and northern portions of Mexico. (Originally described from the mouth of the Yellowstone; redescribed from Chihuahua. Specimens examined by me from Nebraska, Kansas, Texas, and Chihuahua.)

I regret that the material before me includes no specimens in the flesh, since I am thereby prevented from giving the size and form of the species with desirable precision; fortunately, however, in this instance the characters of the species are so strongly marked that lack of elaborate details of form will result in no misunderstanding. The coloration, alone distinctive, can be accurately given from several well-prepared skins before me.

This species, the type of the genus, exhibits very distinctly the two leading features of external anatomy which distinguish *Perognathus* proper from *Cricetodipus*; namely, the lobe of the antitragus and the naked strip of the sole extending quite to the heel. It is much the largest species of the genus known to inhabit the United States, considerably exceeding *P. penicillatus* (which about equals *Hesperomys leucopus* in size), and, in fact, some specimens are little if any smaller than *Tamias quadrivittatus*. For the reason above given, the dimensions cannot be stated with precision; but the length from nose to root of tail is obviously more than four inches in all but one of the specimens before me; the tail is decidedly shorter than the head and body (in all the other species treated in this paper it is as long or longer). The vertebrae of the tail of the only specimen before me in which these bones remain *in situ* measure less than 4.00 inches, the length of the head and body of the same specimen being about 4.50. Likewise, the hind feet are proportionally shorter than in any of the other species; they average only one inch in length, thus not exceeding those of *P. penicillatus*, which is a smaller animal. On the contrary, the ears are larger, both absolutely and relatively, than those of any other species, standing about 0.40 high, measured from the notch; the ears thus project conspicuously above the fur of the parts; the flap is suborbicular in outline; the antitragus develops a very

prominent lobe, bounding the notch posteriorly; and in front of the notch there is also a little prominence, just behind the termination of the margin of the ear. The flattened portions of the auricle are sparsely pilous inside and out, and a tuft of lengthened hairs springs from the front border of the ear.

The attenuated and elongated muzzle is densely pilous, excepting a small T-shaped nasal pad, divided by a median depression. The upper lip, in particular, is thickly covered with stiffish, flaring hairs, completely concealing any median cleft which may exist, and forming a heavy fringe which droops over and almost hides the incisors; there is an antrorse tuft of bristly hairs on the chin. The openings of the cheek-pouches seem to have no peculiar character, being much as in other species of the genus; the cavity admits the first joint of one's little finger. The whiskers are very numerous and fine; the shorter colorless ones seem like mere lengthening of the hairs of the muzzle; others, stiffer and colored, reach rather beyond the head. There are also some long special bristles over the eye, and others between the eye and ear.

The palm proper, and under surfaces of the digits, are perfectly naked, though a considerable fringe of hairs falls down from the wrist. There is a large and conspicuous smooth tubercle on the outer side, at the base of the fifth digit; two others, one on each side, at the wrist, and others at the bases of the intermediate digits; the disposition of these smaller ones is not very evident in the dried specimens. The thumb is rudimentary, a mere stump, bearing a flattened obtuse nail; the other digits are armed with ordinary compressed, acute, and moderately curved claws; the 3d is longest; then come 4th, 2d, and 5th in succession. Of the hind foot, the sole is perfectly naked for its whole length along a median strip, narrowed by encroachment on either side of a fringe of hairs. On the outer side, about half-way from heel to base of digits, is a small tubercle; there is another near the base of the 1st digit, and a much larger one near the base of the 5th digit, with others still at the bases of the intermediate digits; but their precise disposition, and the character of the naked sole, cannot be made out perfectly. The first digit is very small, with a smooth bulbous end and short blunt claw; the other claws are of a more ordinary character, but relatively shorter, blunter, less compressed, and less curved than those of the hand; they are excavated underneath.



The tail is completely but rather thinly haired, and, especially toward the end, the hairs stand apart and are somewhat lengthened (as is usual in the genus); still they do not develop into the decided comb or crest, or tuft at the end, which is characteristic of *P. penicillatus*.

The pelage of this species is coarse, harsh, and stiffish (as in other species of typical *Perognathus*), but not to a degree which could bear the term "spiny", or even "bristly"; it has been likened to fine-spun glass, though such expression might be considered strong, unless excessively delicate glass is meant. The fur has considerable gloss; there is no under fur whatever. The character seems to me to be much as in the Murine *Sigmodon hispidus*, and in fact the specimens before me have considerable superficial resemblance to the young of that species. A likeness to *Zapus hudsonius* is perhaps even stronger. The color of the upper parts is a light sandy-yellowish, closely lined throughout with blackish, producing a fine grizzle. The greater part of the length of the individual hairs is the color of barely-tarnished cut lead; it is rather light, and unlike the heavier plumbeous of most Rodents. This is succeeded by the sandy ends of the hairs; a part of them are of this last color to the very end, while others have the tips blackish, producing the grizzle above mentioned. The line of demarcation of this color begins on the side of the nose, and runs straight over the shoulder and sides of the body, descending the hind limb to the heel. To this succeeds a strip of rich reddish-yellow or salmon-color, beginning on the cheeks and following the line already indicated to the heels, but also descending a little way on the fore leg. This color is pure, the hairs being so colored to the roots, there being no plumbeous basal portions and no blackened tips. The whole under surface, together with the feet, most of the fore leg, and the inner aspect of the hind leg, is white, and on these white areas the hairs are of this color to the roots. The line of demarcation with the fawn-color is pretty sharp, but less so in some cases than in others, sometimes the whole belly showing a tawny shade. The tail is bicolor; a brown or dusky stripe runs the whole length of the upper surface; the sides and under surface being white or tinged with rusty—the latter particularly when the white of the belly is similarly tinged. Besides these special markings, there is decided indication of a dusky stripe from the nose under the eye and ear to the side of the neck, produced by increase of the blackened tips of the hairs along the line. Some of the whiskers are black, others being colorless. The pouches are white inside. The claws are colorless.



My series of specimens does not suffice for a complete exposition of the variation in color of this species. In all, the lateral stripe is conspicuous, and the other characters differ little. I note, however, a decidedly richer tone in Mexican and Texan specimens than in those from Kansas and Nebraska. It is probable that the skull of this animal, when examined, will afford some specific characters, in size at least, if not in details of conformation. The venerable Dr. G. Linneecum, of Texas, lately deceased, has given notes on the habits of this species, in two special articles, below cited.\*

### PEROGNATHUS PENICILLATUS, Woodh.

#### Tuft-tailed Pocket-rat.

*Perognathus penicillatus*, WOODH.,<sup>†</sup> Proc. Acad. Nat. Sci. Phila. vi, 1863, 200 (San Francisco Mts., Arizona).  
*Perognathus penicillatus*, WOODH., Sturges's Rep. Expl. Zuffi and Col. R. 1853, 49, pl. 3.—LEC., Proc. Acad. Nat. Sci. Phila. 1854, 225 (mere mention).—AUD. & BACH., Q. N. A. iii, 1854, 208 (copied from Woodh.).—IBID., M. N. A. 1857, 418, pl. 20, f. 6.—GRAY, P. Z. S. 1868, 201 (wrong locality assigned).—COUES, Am. Nat. i, 1867, 397 (Arizona).—COUES, Proc. Phila. Acad. 1875, 247 (monographic).—COUES & YARROW, Zool. Expl. W. 100 Merid. 1875, 110.  
*Perognathus parvus*, LeCONTE, Proc. Acad. Nat. Sci. Phila. vi, 1863, 235 (in part. Not *Criodipus parvus*, Peale.) (The specimen noticed from the Colorado Desert is now before me; it is apparently a very young example of *P. penicillatus*.)

DIAGNOSIS.—About the size of *Hesperomys leucopus*. Tail vertebræ obviously longer than head and body. Hind foot more than one-fourth the length of head and body. Tail crested above toward the end, and with long terminal pencil of hairs. Soles distinctly naked to the heels, at least along a median strip. Antitragus distinctly lobed, with a sharp teat-like projection, opposite which is another smaller but distinct lobe of the tragus, the notch of the ear being defined by these two prominent points, the edge of the ear itself not bounding the notch at all. No appreciable fulvous stripe along the sides, where the color of the upper parts meets the white of the under parts without intervention of a third color. Above, "gray"—an intimate mixture of yellowish-gray with a dull grayish-brown; below, including whole fore leg, fore and hind feet, and inner aspect of thighs, white; tail bicolor—dark above, white below. Length about 3.25 inches (♂—3.63); tail vertebræ about 4.00 (3.50–4.40), with a tuft half an inch or more longer. Soles about 0.95 (0.90–1.00); ear above notch, 0.83 (0.80–0.85).

\* Pouched Rat. < Am. Nat. vi, 1873, pp. 369, 370.

The Animals of Texas. < Amer. Sportsman (newspaper) of Feb. 28, 1874.

† Special paper: "Description of a new species of *Perognathus*, Wied." < loc. cit., pp. 200, 201.

‡ The San Francisco Mountains are several hundred miles from San Francisco City, California, nearly in the middle of Arizona—formerly a part of New Mexico. The locality appears to puzzle some writers.

HABITAT.—The Basin of the Colorado River. (The very few specimens at present known to naturalists have all come from Arizona and the adjoining border of Southern California.)

(Description from Woodhouse's type, which is mounted, and several more recent specimens, dry and alcoholic.) In all the other species of *Perognathus* given on these pages, the tail, whether longer than the body or decidedly shorter, is simply haired, with the terminal hairs no longer than those surrounding the tail. The present species is therefore remarkably distinguished by the comb or crest of long hairs on the terminal third or more of the member, produced by a gradual lengthening until those at the end are half an inch or more in length, producing a penicillate brush proportionally as long as that of some species of *Tamias* or even *Sciurus*. With this singular character others of equal tangibility are coördinated. The description to be given will include some points common to the genus, as, with one exception, the present is the only species of *Perognathus* of which I have specimens in the flesh.

The head is about one-third of the total length of head and body; broad and full across the temporal and orbital regions, thence tapering rapidly to the produced but rather blunt snout. The muzzle is entirely and densely pilous excepting a small nasal pad, with a median furrow; the nostrils are very small and irregular in contour. The long upper lip is heavily clothed with stiffish hairs, forming a fringe which droops over and hides the incisors. The whiskers are numerous and very fine; besides the labial set, the longest of which much exceed the head in length, there are others about the eye and ear. The eye is of moderate size, and situated much nearer to the ear than to the nose. The ear shows very conspicuously the prominent lobe of the antitragus, which is the chief external peculiarity of this genus as compared with *Cricetodipus*; and opposite to it, on the other side of the notch, there is a similar and smaller, but still very evident, tubercle just within the border of the ear. These two prominences together cause the notch of the ear to be very strongly defined; and the margin of the external ear is altogether excluded from the notch. The contour of the ear is broadly rounded. The slit of the cheek-pouch is about half an inch long, beginning on the side of the upper lip and curving around with a free border to near the angle of the jaw, there being but narrowly separated from its fellow.

The details of the palms and soles, as clearly made out from the material

before me, are probably applicable also to those other species of the genus of which only dried skins are before me. The palm is entirely naked; it presents posteriorly a pair (inner and outer) of immense smooth tubercles, reminding one of the state of the parts in *Geomys*. Anteriorly, there are three smaller but still very conspicuous bulbs; one proper to the base of, respectively, the 2d and 5th digits, and one common to the base of the 3d and 4th. The palm is otherwise uniformly studded with small elevated granulations, and the digits are similarly roughened underneath. The minute thumb ends club-shaped, bearing upon its back a flat nail, which, like that of the human finger, does not project at all beyond the end of the digit. The whole thumb is no more conspicuous than one of the palmar pads. The other digits bear ordinary claws; the 3d is longest; the 2d and 4th are subequal to each other and but little shorter than the 3d; the 5th is more abbreviated, but its claw-tip still falls beyond the base of the 4th claw.

As a consequence perhaps of the desert habitat of this species, the nakedness of the soles, which is one of the secondary characters distinguishing all the species of *Perognathus* from those of *Cricetodipus*, is here carried to an extreme. The sole may be called naked without qualification; for the fringe of hairs which droops over its sides does not encroach in the least upon the under surface except just at the side of the contracted posterior part of the heel itself. The whole sole is uniformly paved with minute granulations. Among these, one constantly larger than the rest is always observed on the inner side about half-way down the metatarsus; and a similar one is found at the base of each of the digits. The digits are marked beneath with transverse lines of impression, and end in smooth, slightly clubbed tips. The first digit, though small, is perfectly formed, and bears an ordinary claw, the tip of which falls opposite the base of the second digit; the longer 3d digit but slightly exceeds the 2d and 4th, which are about equal to each other; the end of the claw of the 5th digit falls opposite the middle of the 4th one.

In the development of the hind limbs of this and the next closely allied species of *Perognathus*, there is more indication of a saltatorial tendency than appears in the case of *P. fasciatus*, but the difference is not very striking; it is no more than that which may be inferred on comparison of *Cricetodipus parvus* with *C. flavus*, and it falls far short of the state of the case exhibited by *Dipodomys*. Still, the supposed saltatorial character is further borne out,

upon analogy, by the peculiar character of the long penicillate tail, already fully described.

I find it difficult to describe the color of the upper parts satisfactorily. It was called by Baird "a light dull yellowish-brown or tawney, lined with dark-brown". The prevailing tone is decidedly "gray" in comparison with the strong mixed yellowish and blackish of *P. fasciatus*—somewhat the shade of dilute coffee and milk. The lighter hairs are dull yellowish-gray, with darker lining of hair brown. There is a general tinge of the palest possible cinnamon. All the bases of the hairs are of the color of fresh-cut lead. There is no appreciable lateral stripe of different color from the upper parts, although, just along the line of junction with the white, the color lightens a little for lack of the darker brown lining. The extreme tip of the snout, the cheeks, the whole fore leg, the inner aspect of the hind leg, the feet, under side of tail, and under parts generally, are white; the line of demarcation runs straight from nose to hind leg, where it drops down to the heel. The upper surface of the tail and the brush at the end are hair-brown. Some of the whiskers are black; others, like the claws, are colorless.

The external sexual characters of this and other species of the family are readily recognizable. In consequence of the development of the os penis, the præputial sheath is a resisting prominence immediately in advance of the anus. The same part in the female shows a conical flap depending from the front of the vulva.

Having only about a dozen adult specimens of this species to examine, the full range of variation can only be given with approximate accuracy. Still the series is a very good one as far as it goes, and the number of alcoholics afford reliable measurements. Dr. Woodhouse's type is much faded by twenty years' exposure to the light. The others agree perfectly in coloration, and the differences in size are slight. I may here remark that, in Professor Baird's table of measurements the dimension (nose to tail) given from the dried specimens there enumerated is certainly over the mark. Thus, Woodhouse's type is given as 4.12 long, whereas the original description of the same specimen says 3.50.

TABLE I.—Measurements of eleven specimens of *PEROGNATHUS PENICILLATUS*.

Current number.	Locality.	Sex.	From tip of nose to—				Tail to end of—		Length of—		Height of ear.	Nature of specimen.
			Eye.	Ear.	Occiput.	Tail.	Vertebæ.	Hairs.	Fore foot.	Hind foot.		
3576	San Francisco Mountains, Ariz.	..	..	0.60	..	3.50	3.70	..	0.45	1.60	0.30	Mounted.
1332	Colorado River, Cal.	..	..	..	..	..	3.00	3.00	..	0.90	..	Dry.
1333	Fort Yuma, Cal.	..	..	..	..	..	3.65	4.15	0.40	0.95	0.30	.. do.
1345	Colorado Desert, Cal.	..	0.50	0.90	1.00	2.50	3.15	..	..	..	..	Alcoholic.
8910	Camp Grant, Ariz.	♀	0.60	0.95	1.10	2.00	3.50	4.00	0.35	0.85	0.30	.. do.
4291a	Mojave Village, Ariz.	♂	0.63	1.00	1.35	3.30	..	..	0.45	1.00	0.33	.. do.
4344b	.. do.	♀	0.55	0.90	1.10	3.00	3.50	4.00	0.40	0.95	0.35	.. do.
4946c	.. do.	♂	0.55	0.90	1.10	3.00	4.00	4.00	0.40	0.90	0.30	.. do.
4946d	.. do.	♂	0.60	0.95	1.30	2.00	4.35	4.80	0.40	0.95	0.35	.. do.
4946e	.. do.	♂	0.65	0.95	1.30	3.50	4.30	4.90	0.40	1.00	0.35	.. do.
4946f	.. do.	♂	0.60	0.90	1.50	3.60	4.45	5.00	0.40	1.00	0.35	.. do.

\* Measurements of length and of tail-vertebræ from Woodhouse. In its present state, the tail, as well as can be judged, is about 4.50 long, exclusive of the terminal pencil, which is half an inch more. The dry measurements are not reliable.

Taking the last seven sets of measurements of the foregoing table (all made from sexed specimens in the flesh, and taken by the same person,\* so that a source of error which lies in different methods of measurement is avoided), we observe that the total length varies from 2.90 to 3.60—a difference of 0.70—a fair rate of variability for a species. The tail, as usual, varies more than the body, or, in this instance, about an inch, whether the vertebræ alone are considered, or the terminal pencil be taken into account. The relatively shortest tail (vertebræ alone) is half an inch longer than the head and body, or, with the hairs, an inch longer. The relatively longest tail (vertebræ alone) is an inch and a quarter longer than the head and body; with the hairs, nearly two inches longer. Much as usual, the rate of relative variability is greater than that of absolute difference in dimension. The soles vary a tenth of an inch in length, or about 9½ per cent. of their average length. Other smaller measurements give corresponding results. The rates of variation which are determined for the present species are doubtless equally applicable to others of the genus of which I have no alcoholic specimens.

Upon the supposition that the other allied species described in this paper are really distinct from *P. penicillatus*, this has a remarkably restricted geographical distribution. So far as I am aware, there are no specimens extant from beyond the limits of the Colorado Valley in that portion of its extent

\*In measuring tails, I take as nearly as possible the true length, by placing one leg of the compasses snugly above the anus. The length to which the tail projects beyond the body-hairs, or its ostensible dimension, is considerably less.

which embraces Arizona and the contiguous part of California on the opposite side of the river. Specimens are rare; there may be none whatever in Europe. Woodhouse, LeConte, Baird, and myself are possibly the only naturalists who speak of the species from autoptical examination.

The relationships of some allied species being considered under other heads, the only point here arising for discussion relates to the "*Cricetodipus parvus*" of LeConte, *l. c.* The specimen upon which that writer based his remarks is now before me. It is not adult, as supposed, but very young and ungrown, as shown by the unworn state of the teeth; although the tail is not crested, there are indications that it would have become so; the relative proportions and coloration are exactly as in *P. penicillatus*, to which I have little hesitation in referring it. In any event, it is a true *Perognathus*, and not *Cricetodipus* at all, as shown beyond question by the obviously naked soles and distinctly recognizable lobe of the antitragus.

#### PEROGNATHUS MONTICOLA, Baird.

##### Mountain Pocket-mouse.

*Perognathus monticola*, BAIRD, M. N. A. 1857, 422, pl. 51, figs. 3a-b (St. Mary's, Rocky Mountains).—SUGEL, P. R. R. Rep. xii, pt. II, 1860, 101 (notice of the same specimen).—COUES, Proc. Phila. Acad. 1875, 293 (described from another specimen from Fort Crook, Cal.).—COUES & YARROW, Zool. Expl. W. 100 Merid. 1875, 110 (two specimens doubtfully referred here).  
*Perognathus multiplicatus*, COUES, Proc. Acad. Nat. Sci. Phila. 1875, 296 (provisional appellation).  
*Perognathus lordi*, GRAY, P. Z. S. 1868, 203. (*Teste Alston, epist.*)

• **DIAGNOSIS** (No. 7251, Mus. Smiths. Inst., ♀, Fort Crook, Cal., J. Feilner).—Size of *Mus musculus*. Tail, including hairs, an inch longer than the head and body, the vertebræ alone over half an inch longer. Hind foot nearly one-third as long as head and body; naked strip on sole very narrow posteriorly; antitragus with a great, flat, rounded, upright lobe, but no lobe of tragus opposite, the notch being defined in front by the outer edge of the ear itself. Tail not penicillate nor crested; rather thinly but nearly uniformly haired throughout. Pelage very soft and smooth for this genus—much as in *Cricetodipus*. Color of upper parts descending on the fore leg to the wrist. A fulvous lateral stripe, indistinct but evident; hairs of under parts pure white to the roots; tail bicolor. Above, yellowish-cinnamon lined with blackish, the latter predominating; below, white.

**DIMENSIONS**.—Length, 2.50; tail-vertebræ, 3.20; hind foot, 0.80.

**HABITAT**.—St. Mary's Mission, west of Rocky Mountains, to Otter Creek, Utah, and Fort Crook, California.

The generalities of form of this animal are much the same as those of its nearest allies. In relative length, the tail nearly equals that of *P. penicillatus*, but it is uniformly haired throughout, without indication of crest or penicillation. The soles are also extensively denuded as those of *P. penicillatus*, owing to encroachment of hairs from the sides; still there is a fairly naked strip to the extreme heel. The tuberculation of the palms and soles, and the proportions of all the digits, are substantially as in that species. The animal is much smaller than any other species of the genus, not much exceeding a *Cricetodipus* in size. But the most remarkable character is found in the structure of the ear: it is singular how sharply distinguished some species of the genus are in this respect. In *P. penicillatus*, a sharp teat-like projection of the antitragus defines the notch posteriorly, and opposite to it, on the other side of the notch, there is a similar but smaller prominence of the tragus bounding the notch anteriorly; thus the external edge of the ear itself is altogether excluded from the formation of the notch. Now, in *P. monticola*, the lobe of the antitragus is a broad, flat, upright flap, both relatively and absolutely larger than that of *P. penicillatus*, but there is no corresponding lobe of the tragus on the other side of the notch, the front border of the notch being formed by the external edge of the ear itself. This state of the parts is an approach to the condition seen in *Cricetodipus*, and is a perfectly distinctive mark of *P. monticola* in its own genus. This important distinction escaped the describer of the species; but it should be added that it is only fully appreciable upon examination of fresh or alcoholic specimens, and that the type of the original description had been mounted when examined. Furthermore, the ears of *P. monticola* are smaller than those of *P. penicillatus*, and scarcely more than half the size of those of *P. fasciatus*.

Another good character of the species is found in the softness and fineness of the fur. The pelage is not so stiff and firm as in *P. penicillatus* even, and has nothing of the "spun-glass" character seen in *P. fasciatus*, and still more noticeable in *P. hispidus*.

The coloration of the species is mainly distinctive in the circumstance that the dark color of the upper parts descends the fore leg to the wrist, whereas on all the other species examined the whole fore leg is white. The upper parts are an intimate mixture of tawny and blackish, much as in *P. fasciatus*. There is an evident but not very distinct lateral fulvous stripe. The under parts, in the specimen described (No. 7251), are light yellow, but



this is undoubtedly the effect of alcoholic discoloration, the parts being, no doubt, white in life. The tail is bicolor, to correspond with the body colors.

While there is no question whatever of the distinctness of the subject of the present article from any others described in this paper, there are some points to be considered respecting its reference to *P. monticola* of Baird. The type of this species, now before me, has been mounted and exposed to the light for about twenty years; it is faded and otherwise in poor state, the end of the tail and much of the fur being lost. The color is now a uniform dull grayish-brown, much like the natural color of *P. penicillatus*, instead of "mixed cinnamon and dusky", as originally described; and the tail is uniformly dingy white, instead of being "colored to correspond"; the hairs below are all white instead of "plumbeous at base"; and no lateral stripe is now appreciable, though an "indistinct" one was mentioned. But the main peculiarity of the species as to coloration, namely, the descent of the dark color down the fore leg to the wrist is still evident; and, in short, I find no color-differences not explicable upon consideration of the comparative state of the two specimens. We may therefore turn to the matter of size and proportions. Professor Baird says, "tail rather shorter than head and body," giving the length of the former as 2.67+, and of the latter as 3.00; whereas my animal is but 2.50 long, and has a tail of 3.20. But the decided discrepancies in these statements and measurements are readily reconciled upon the simple consideration that the tail is defective and the body overstuffed in the type of *monticola*. This brings about an agreement further borne out by the other measurements. In the following table, the first line of measurements is copied from Baird; the other is taken from the Fort Crook specimen, upon which this article is based, before skinning out of alcohol.

TABLE II.—Measurements of two specimens of PEROGNATHUS MONTICOLA.

Current number.	Locality.	From tip of nose to—					Tail to end of—		Length of—		Height of ear.	Nature of specimen.
		Sex.	Eye.	Ear.	Occiput.	Tail.	Vertebra.	Hairs.	Fore foot.	Hind foot.		
431	St. Mary's, Rocky Mountains.....	.....	0.46	0.99	1.06	3.00	2.67+	.....	0.80	0.85	.....	Mounted.
7251	Fort Crook, Cal.....	♀	0.53	0.85	1.00	2.50	3.20	3.50	0.30	0.80	0.30	Alcoholic.

The principal discrepancy being explicable as above, there is nothing whatever in the foregoing table incompatible with specific identity. More-



over, it so happens that the left ear of the type is in sufficiently good preservation to enable me to clearly recognize the peculiar conformation which distinguishes the present species from the others.

To this same species I am also inclined to refer two specimens recently collected by Mr. H. W. Henshaw on Otter Creek, in Utah. These are apparently young animals, but, as they are not accompanied with the skulls, the fact cannot be determined.\* The tail of each has been skinned, and is now so shrivelled that nothing can be predicated as to its length, either relative or absolute. The specimens are quite small; they have been overstuffed, measuring now about  $2\frac{1}{2}$  inches, but were probably not much, if any, over 2, with a hind foot of 0.80; in fact, they might be taken at first sight for *Criceodipus*. But the soles are naked along a narrow strip quite to the heel; the antitragus has a very prominent lobe; and even from the dried skins I determine, with no appreciable chance of mistake, that the ear has the other peculiarity of *P. monticola*. The pelage is remarkably soft; the coloration is different from that of any other *Perognathi* I have seen, being plumbeous (like the plumbeo-colored specimens of *Geomys* and *Thomomys*), with little admixture of lighter color; and the soles show a decided fulvous stripe. But these specimens exhibit the fore leg colored quite to the wrist, and I am inclined to attribute the dark color to their immaturity. I shall therefore assign them to *P. monticola*.

The four specimens noticed are the only ones which have come under my observation. To sum the case in a few words, we have here an animal unquestionably distinct from any of the other species described in this paper, the only question being whether all the specimens referred to it are specifically identical. They ostensibly differ to a degree that might have caused them to be described as distinct at the period when Professor Baird's work was prepared. This question must await the reception of additional material for its satisfactory solution. I can only say that I am at present unable to see more than one species. Should the contrary be determined, the present article is to be held as based upon the Fort Crook specimen, for which I have suggested the name of *P. mollipilosus* as a provisional designation.

\* Since this was written, Mr. Henshaw tells me the animals are very young indeed—they had not left the nest when captured. These are the specimens doubtfully noticed by Dr. Yarrow and myself, in Wheeler's Report, &c.

## PEROGNATHUS HISPIDUS, Baird.

## Hispid Pocket-mouse.

*Perognathus hispidus*, BAIRD, M. N. A. 1857, 421, pl. 51, fig. 4a-g.—BAIRD, U. S. and Mex. B. Surv. II, pt. II, 1859, Mamm. 42.—GRAY, P. Z. S. 1868, 303 (compiled).—COUES, Proc. Phila. Acad. 1875, 296 (rediscovered, but without material additional to that in Baird's hands in 1857).

DIAGNOSIS.—Ear small, not projecting beyond the fur; its structure as in *P. fasciatus* and *penicillatus* (tragus and antitragus both lobed). Soles naked. Tail not penicillate, rather longer than head and body. Fur exceedingly stiff and coarse. Above, yellowish-cinnamon, closely lined with blackish, the color not descending on the fore leg at all. Sides with a conspicuous fulvous stripe. Tail bicolor. Under parts, with hind feet and whole of fore leg, white.

Length between 3.00 and 3.50; tail rather more. Sole of hind foot 0.90.

HABITAT.—The only two specimens known of this species were procured by Lieut. D. N. Couch at Charco Escondido and Matamoras, Tamaulipas.

Since the introduction of this species, as above, no additional specimens have come to hand; and as we have no further material for amplification or verification of the original description, there is little more to be said about it at present. The animal appears to be perfectly distinct from any other described in this paper. With much the same size and proportions as those of *P. monticola*, it is immediately distinguished by the radical difference in the conformation of the ear, the stouter as well as rather longer feet, and the whiteness of the whole fore leg. From *penicillatus* it differs in the much shorter and not penicillate tail, less extensively denuded soles, and presence of a strong lateral fulvous stripe. It is decidedly smaller than *P. fasciatus*, with which it shares the fulvous stripe, with a tail longer instead of shorter than the body; ears scarcely half as large, &c. From all these species, finally, it differs in the extraordinarily harsh, stiff, coarse hair; this is of great length and devoid of under fur, as in other species, but represents, in an exaggerated degree, the pelage which is characteristic of the genus in distinction both from *Dipodomys* and *Cricetopus*.

The coloration of the species cannot be given with sufficient accuracy. Both the specimens have been skinned out of alcohol, and the tints are probably somewhat modified. One of them has been so discolored by long immersion in a dirty fluid as to be of a uniform dingy greenish-brown, in which the

original colors cannot be in the least discovered. The other, in better state, shows the characters pretty well. There is a strong fulvous or salmon-colored stripe along the whole body, just as in *P. fasciatus*. The light color of the upper parts is rather a pale cinnamon than the sandy yellowish of *P. fasciatus*. The hairs are light plumbeous at base, and many of them are tipped with black, giving the dark surface-lining. The tail is sharply bicolor, to correspond with the body. The under parts, including the whole fore leg and the foot and inside of the hind leg, are white.

As in the case of *P. monticola*, further information respecting this species is much to be desired, particularly as there appear to be some Mexican animals of this genus with which we are at present not well acquainted. The following measurements are those given by Baird in his original notice:—

TABLE III.—Measurements of two specimens of *PEROGNATHUS BIRPIDUS*.

Current number.	Locality.	Sex.	From tip of nose to—			Tail to end of—		Length of—		Height of ear.	Nature of specimen.	
			Eye.	Ear.	Occiput.	Tail.	Vertebra.	Hair.	Fore foot.			Hind foot.
577	Charco Escudido.....	♀	0.84	0.93	1.33	3.18	.....	.....	0.42	0.24	0.37	Alcohol.
576	Matamoros.....	♂	0.87	1.00	1.33	3.50	3.00	3.30	0.45	0.26	0.37	.....do.

In my previous "Review" of this family (Proc. Phila. Acad. 1875, 29\*), I quoted the original notice\* of "*Abromys lordi*" of Gray (P. Z. S. 1868, 202), observing that "we may suppose the animal to be a *Perognathus*, from the general tenor of Dr. Gray's remarks, and his curiously mixed-up quotations; and it is perhaps *P. monticola*. . . ." This supposition is probably verified

\* The following is the original notice of the genus and species in full:—

"3. *ABROMYS*, Gray.

"Upper cutting teeth with a longitudinal groove; fur soft, abundant, uniform, long, and close. Tail tapering, cylindrical, covered with short hair almost hiding the rings of scales.

"*Perognathus*, sp., S. Baird, Mamm. N. A. 423.

"*ABROMYS LORDI*.

B. M.

"Fur soft, abundant, gray-washed, with blackish tips; chin and under side of body whitish; tail tapering, gray, with a blackish-brown upper surface and tip; hair of the back dark lead-color, with a short gray band and minute black tip.

"*Perognathus monticolor* [sic], Lord, in B. M.

"? *Perognathus monticola*, S. Baird, Mamm. N. A. 423, t. 51, f. 3 (skull).

"*Hab.* British Columbia (Lord).

"The teeth destroyed. Length of body and head 3 inches, of tail 3 inches. It differs from *Dipodomys phillipsii* and other species of that genus in having no white spot over the eye at the base of the ear, or white band across the thigh."

by Mr. E. R. Alston, from examination of the original specimen, kindly made at my request. Mr. Alston writes:—"The type of '*Abromys lordi*' is in bad condition, the ears being hopelessly distorted; but it seems to me to be undoubtedly *P. monticola*."

### PEROGNATHUS BICOLOR, Gray.

#### Honduras Pocket-mouse.

*Perognathus bicolor*, GRAY, P. Z. S. 1868, 202. (Honduras. Description confused with that of a species of *Heteromys*—*teste* ALSTON, *epist.*)

Though not an inhabitant of North America as zoologically understood, this species is introduced to complete an account of the genus, and to furnish the occasion for correction of an important error into which the describer was led. The original notice is subjoined.\*

Mr. Alston writes me, after examination of the type:—" *P. bicolor* Gray, (from Honduras,) appears to be a good species, but has been curiously badly described. It is dark brown above, not black, and tho' the fur is sparse and somewhat harsh, it is not in the least bristly! Gray seems to have had both this specimen and his *Heteromys melanoleucus* in his hands when he wrote, and to have confused one with the other."

### GENUS CRICETODIPUS, Baird.

=? *Cricetodipus*, FRAILE, U. S. Expl. Exped. 1848, 52. (Type —?)

= *Cricetodipus*, BAIRD, M. N. A. 1855, 418. (Type *Perognathus flavus*.)—GRAY, P. Z. S. 1868, 202.—COUES, Proc. Phila. Acad. 1875, 300.

= *Otognosis*, COUES, Proc. Phila. Acad. 1875, 305. (Provisional name. Type *Perognathus flavus*.)

In treating of this form as a subgenus of *Perognathus*, Professor Baird clearly showed its external peculiarities, namely, absence of lobation of the antitragus, hairy soles, and diminutive size. To these points are to be added the cranial peculiarities coincident with decidedly greater development of the mastoid than that seen in *Perognathus*. The characters having already been given (p. 496), it is needless to repeat them.

\* "PEROGNATHUS BICOLOR,

B. M.

"*Perognathus monticola*, Gerrard, Cat. Bones B. M. (not Baird). Black; upper lip, lower edge of the cheek-pouch, head, and under side of body and inner side of limbs white. Fur uniform bristly; bristles elongate, slender, with a slender point, and intermixed with very slender elongated hairs. Tail as long as the body, with rings, square scales, and short bristly hairs.

"*Hab.* Honduras (*Sallé*).

"There is a Spiny Rat from Honduras\* with a longer tail and smooth frontteeth, agreeing in color with the above." The confusion of ideas intimated by Mr. Alston is here obvious.

\* Characterized on p. 304 of the P. Z. S. for 1868 as *Heteromys melanoleucus*, with "*Perognathus monticola* [*sic*], Gerrard, B. M. not S. Baird", quoted as a synonym.

As noticed further on, the *Cricetodipus parvus* of Peale is an uncertain animal. In erecting *Cricetodipus* into a genus, I take *C. flavus* of Baird as the type, and follow this author in distinguishing a second species, which latter is probably, but not certainly, the *C. parvus* of Peale. The two appear to constantly differ in the following characters:—

Tail scarcely or not longer than the head and body; hind foot scarcely or not one-third as long as head and body.

Tail decidedly longer than head and body; hind foot more than one-third as long as head and body.

FLAVUS.  
PARVUS (of Baird).

### CRICETODIPUS FLAVUS, Baird.

#### Yellow Pocket-mouse.

*Perognathus flavus*, BAIRD, Proc. Acad. Nat. Sci., Phila. 1855, 332.—BAIRD, M. N. A. 1857, 423, pl. 8, f. 2, pl. 21 f. 3a-f (assigned to *Cricetodipus*).—BAIRD, P. R. R. Rep. x, 1859, (Jennison's and Beckwith's Route, Mamm. p. 8.—BAIRD, U. S. Mex. B. Surv. II, pt. II, 1859, Mamm. 42.—SUCKL., P. R. R. Rep. xii, pt. II, 1860, 101 (Montana).—HAYD., Trans. Am. Phil. Soc. xii, 1862, 147 (Loup Fork of Platte).—ALLEN, Proc. Bost. Soc. N. H. xii, 1874, 43 (Yellowstone River).  
*Cricetodipus flavus*, GRAY, P. Z. S. 1868, 303 (compiled).—COUES, Proc. Phila. Acad. 1875, 300 (monographic).—COUES & YARROW, Zool. Expl. W. 100 Merid. 1875, 109.  
*Otognosis flava*, COUES, Proc. Phila. Acad. 1875, 305 (provisional name).

DIAGNOSIS.—Much smaller than *Mus musculus*; head and body two inches; tail the same; hind foot 0.65; ear small, not overtopping the fur, simple, without lobe of antitragus or tragus. Soles entirely hairy on the posterior half. Tail not decidedly longer than the head and body. Hind foot scarcely or not one-third as long as head and body. Above, pale buff, intimately blended with blackish; below, including whole fore leg, snowy white; sides with a clear buff stripe; tail obscurely bicolor; white touches often found about the ears.

HABITAT.—Rocky Mountain region of the United States and eastward in the Middle Faunal Province, from the British Possessions (lat. 49°, *Coues*) to Chihuahua, Mexico. (In the Pacific region replaced by *C. parvus*.)

(Description from numerous alcoholic and dry specimens, including Baird's types)—In general points of exterior conformation, this animal is so similar to species of *Perognathus* already fully treated that the account of these features may be abridged. The generic character of structure of the ear and hairiness of the sole, with the diminutive size, are the chief points. The ear is very small and simple, not overtopping the fur of the parts. It is evenly rounded; there is no lobation whatever of either antitragus or tragus, the slight notch which exists being formed in front by the fold over edge of the ear itself, and behind by the antitragal ridge. The head is full,

especially in the frontal region, tapering to a bluntly conical snout, which is densely hairy excepting a minute nasal pad; the upper lip is heavily pilous with a fringe of hairs which droop over and hide the incisors. The eye is rather small, and nearer to the ear than to the nose. The whiskers are very numerous and fine, the longest exceeding the head. On the palms are observed posteriorly two great tubercles, of which the inner is much the largest; there are others at the base of the 2d and 5th, and of the conjoined 3d and 4th digits, respectively; otherwise the palm is studded with minute granulations. The thumb is rudimentary, bearing a small flat nail; the other claws are of ordinary character; 3d longest; 4th little less; 2d shorter; 5th still shorter. The hairiness of the soles posteriorly is a generic character in comparison with *Perognathus*; anteriorly they are granular, with a tubercle at the base of each digit, and another on the outer side of the metatarsus a little way up. The small size of the hind feet, however, is one of the most obvious distinctions from *C. parvus*. The longest hind foot measured in upward of twenty cases is only 0.70 long, or barely one-third of the length of head and body, while the average is much below this, and the minimum is only about one-fourth of the length of the head and body. We may say simply that the foot is usually nearer one-fourth than one-third of this dimension. Similarly, the shortness of the tail is a second character. In a large series, the vertebrae of the tail average exactly as long as the head and body; in no case does the tail exceed the body and head by more than 0.25 of an inch, and this length is only exceptionally reached. In most cases, any difference which may be observed is the other way, the tail being, if anything, a little shorter than the head and body. The tail, as in other species of this genus and of *Perognathus* (except *P. penicillatus*), is closely, but not very thickly, haired uniformly throughout; the terminal pencil is about 0.10 of an inch long.

The pelage is extremely fine, soft, and glossy. The pattern of coloration is the same as in other species of this genus and *Perognathus*, namely, colored above with blended light and dark tints, white below, with a clear, single-color stripe along the sides. The upper parts are an intimate mixture of pale yellowish-buff with dark brown or blackish; the hairs are clear lead-color basally, then buff-ringed, then (most of them) dark-tipped. The resulting tone is nearly uniform over all the upper parts; but there are liable to appear whitish or rawny touches about the ears and eyes, and an appearance of a dark streak along the side of the head. The fawn-colored lateral stripe is uninterrupted from nose to heel; the tint is rather brighter than the buff

of the upper parts, and pure, being not mixed with any dusky, and the color extending to the roots of the hairs. The entire under parts, including the whole fore leg, the hind feet, and inner side of hind leg, are snowy white, the hairs having no basal color. The tail is obscurely bicolor, white below, and not very sharply colored above to correspond with the areas of the body.

Very young specimens, though nearly full grown and showing a sharp lateral streak, are more simply colored above than the adults, being grayish, with extremely faint buffy lining, instead of sharply blackish and buff. There is also observable, in the series before me, a tendency to exhibit two different tones of coloration. Those from dry regions east of the mountains are mixed grayish-brown and grayish-buff, with the lateral pale buff stripe not very conspicuous. In New Mexico, Southern Texas, and southward, the animal frequently assumes a ruddier shade of the light color, mixed with much less blackish; in these, the lateral stripe is quite indistinct, because the upper parts in general are not very different. But the distinctions in these cases are not strong enough to require anything further than this notice of the fact.

The following table of measurements will illustrate the size and shape of the species very fairly, and to some extent expose the range of variation:—

TABLE IV.—Measurements of eighteen specimens of *CRICKETODIPUS FLAVUS*.

Current number.	Locality.	Sex.	From tip of nose to—					Tail to end of—		Length of—		Nature of specimen.
			Eye.	Ear.	Occiput.	Tail.	Vertebra.	Hairs.	Fore foot.	Hind foot.		
2615	Milk River, Mont. ....	...	0.40	0.75	0.95	2.25	2.15	.....	0.30	0.70	Alcoholic	
11666	Montana.....	...	.....	.....	.....	.....	.....	.....	.....	.....	Dry.	
4331	Yellowstone.....	...	.....	.....	.....	.....	.....	.....	.....	.....	... do.	
3097	Black Hills.....	...	.....	.....	.....	2.00	2.20	.....	.....	.....	... do.	
3614	Ree Fork, "Neb.".....	...	0.45	0.80	0.95	2.40	2.30	.....	0.30	0.65	Alcoholic	
1931	Republican River, "Neb.".....	...	0.40	0.70	0.85	1.85	1.90	.....	0.50	0.60	... do.	
3254	Loup Fork.....	...	.....	.....	.....	.....	.....	.....	.....	.....	Dry.	
7340	.....do.....	♀	.....	.....	.....	2.20	2.30	.....	.....	.....	Alcoholic	
3050	Pole Creek.....	...	.....	.....	.....	.....	.....	.....	.....	.....	Dry.	
4679	Fort Laramie.....	♀	.....	.....	.....	2.25	2.30	.....	.....	.....	Alcoholic	
7349	Fort Bliss, N. Mex.....	♂	.....	.....	.....	1.10	2.00	.....	.....	.....	... do.	
270	Chinarron, N. Mex.....	♂	0.45	.....	0.85	2.15	2.00	.....	.....	.....	Dry.	
.....	Arizona.....	♀	.....	.....	.....	1.80	2.00	.....	.....	.....	Alcoholic	
.....	.....do.....	♂	.....	.....	.....	1.90	1.90	.....	.....	.....	... do.	
1041	El Paso, Tex.....	...	0.40	0.70	0.85	2.00	1.80	.....	0.35	0.65	... do.	
1043	San Antonio, Tex.....	...	0.45	0.75	0.95	2.30	2.20	.....	0.30	0.60	... do.	
9683	Chihuahua.....	...	0.40	0.70	0.85	1.85	1.60	.....	0.25	0.55	... do.	
9612	Matamoros.....	...	0.45	0.80	0.95	2.15	2.40	.....	0.35	0.65	... do.	
	Average .....	.....	0.42	0.74	0.90	2.07	2.06	.....	0.30	0.63		



## CRICETODIPUS PARVUS, Baird (and Peale?).

## Least Pocket-mouse.

? *Cricetodipus parvus*, PEALE, U. S. Expl. Exped. 1848, 53, "pl. 13, f. 9".—GIBBEL, Säug. 1855, 600 (compiled from Peale).—GRAY, P. Z. S. 1868, 203 (compilation of doubtful references).

? *Perognathus (Cricetodipus) parvus*, AUD. & BACH., Q. N. A. III, 1854, 328 (copied from Peale).

*Perognathus parvus*, BAIRD, M. N. A. 1857, 425 (based on a specimen from King's River, Cal., doubtfully referred to *C. parvus* of Peale).—BAIRD, P. R. E. Rep. x, 1859, Williamson's Route, 82 (same specimen).

*Cricetodipus parvus*, COUES, Proc. Phila. Acad. 1875, 303 (monographic).

*Otioglossis longimembra*, COUES, Proc. Phila. Acad. 1875, 303 (provisional name).

DIAGNOSIS.—Quite like *C. flavus*; tail and feet longer. Hind foot 0.70 or more, one-third or more as long as head and body. Tail decidedly longer than head and body; the vertebrae about 2.50 inches to a body of 2.00.

HABITAT.—United States, west of the Rocky Mountains. California, Utah (and ?Oregon, Peale).

Of this supposed species, I have two specimens additional to the material in Professor Baird's hands in 1857. One of them, alcoholic, in good preservation, enables me to give the dimensions with accuracy.

(No. 9856, Mus. Smiths. Inst. ?; Fort Tejon, Cal, *J. Xantus*.) Nose to eye 0.45, to ear 0.70, to occiput 0.90, to tail 2.00; tail vertebrae 2.50, with hairs 2.75; fore foot 0.25; hind foot 0.70; ear above notch 0.25.

Another specimen, from Utah (No. 439, Mus. Smiths. Inst., formerly referred by Baird to *C. flavus*), seems to belong to *C. parvus*; the hind feet are still longer—nearer 0.80 than 0.70—and the tail at least as long as in No. 9856.

A third specimen, recently collected by Mr. H. W. Henshaw in California, seems to be unquestionably referable to this species. These three are all I have seen.

As well as can be judged from the insufficient material before me, this species does not differ materially in color from *C. flavus*; and in fact the only diagnostic characters at present appreciable are the greater length of the hind feet and tail. There is, however, a decided difference in these respects. Further material will be required to confirm the specific distinctness here accorded, or to show that the two supposed species intergrade. Leaving this matter, we may turn to the history of the species, some points of which call for remark.

In the first place, it is not certain that the animal called *parvus* by Baird



in 1857, and by myself in the present instance, is really the *C. parvus* of Peale. Professor Baird spoke guardedly in the matter, although he did not formally query his citations, as I have done, and I find myself equally in doubt. Nor do I see how the point is to be determined. For Peale's type, having been lost or mislaid, is not at hand to testify; and Peale's description, though elaborately detailed, will be found to consist entirely of supergeneric characters, shared by all the species of *Perognathus* and *Cricetodipus*, excepting the phrase "color above sepia-brown", which is applicable to none of the species known to me. The dimensions assigned agree exactly with those of the animal defined in this article; but they are equally applicable to a very young *Perognathus*. In fine, there is no *proof* that Peale's genus and species were not based upon a young *Perognathus*—possibly *monticola*. Therefore, while glad to concede that the probabilities are the other way, I think it safest to query the citation of Peale's animal and the compiled references that go with it; and I rest upon the *Perognathus parvus* of Baird, about which there is no uncertainty. LeConte's *P. parvus*, as I have already shown, is doubtless based upon a very young example of *P. penicillatus*.

Baird's animal, from King's River, Cal., is very immature, as shown by the state of the teeth, though nearly or quite full grown. It curiously resembles a very young *P. penicillatus* (like LeConte's specimen for instance); and, indeed, Professor Baird was led, by its immaturity and defective state of preservation, to suggest that it might not possibly belong to *P. penicillatus*, though he proceeded to make it the basis of his *P. parvus*. It is, however, unquestionably a *Cricetodipus*, as I can affirm without qualification from inspection of the skull, which clearly shows the bulge of the mastoid back of an occipital emargination and other cranial characters diagnostic of *Cricetodipus*, to say nothing of the hairy soles and unlobed antitragus. I therefore accept the species as first clearly defined by Baird, without necessarily involving the question by including the doubtful animal of Peale.

As already suggested, the chances are that Baird was right in identifying his species with that of Peale, so that the name *Cricetodipus parvus* will probably stand. But should the contrary prove to be the case, and *Cricetodipus*, Peale, 1848, be conclusively shown to be a synonym of *Perognathus*, Maxim., 1839, a new name, generic and specific, will be required for the subject of the present article. The name *Orognotis* would be appropriate, in allusion to the facility with which the species may be distinguished from those of

*Perognathus* by the structure of the ear. The present species may be called *O. longinembria*, as the length of the hind limbs and tail is its specific character in comparison with *O. flava*.

## SUBFAMILY DIPODOMYINÆ.

= *Dipodomys* (genus), of AUTHORS.

= *Dipodomys*, COUES, Proc. Phila. Acad. 1875, 277.

= *Macrocolini*, BRANDT, Beit. Kennt. Säug. Russl., vierte Abb., Fortsch. Grupp. Nager, 1855, p. 231 and p. 311.

The characters upon which this group is based having been given on a preceding page (p. 434), we may at once proceed to consider the single genus by which it is represented.

## GENUS DIPODOMYS, Gray.

= *Dipodomys*, 1 GRAY, Ann. Mag. Nat. Hist. vii, 1841, 521. (Type *D. phillipii*.)

= *Macrocolinus*, 2 WAGNER, Archiv für Naturg. 1846, Bd. i, 173. (Type *M. haiticus*.)

CHARS.—(a. *Cranial*.)—Skull light, thin, papery, depressed, broad behind with swollen curves, tapering in front; rostrum acuminate, produced beyond the nares; no interorbital constriction; palate plane; occipital surface deeply emarginate. Zygomatics straight, thread-like, depressed to palatal plane; abutting against tympanics. Anteorbital foramina represented by a circular perforation of the front of the maxillaries. Large excavated lachrymals. Parietals triangular; an elongate interparietal embraced between forks of occipital. Squamosals reduced to small plates bounding the orbits posteriorly; other elements of the temporal bone extraordinarily developed, thin, and bladderly, their sinuses of nearly as great capacity as the cerebral cavity; the mastoids especially enormous, constituting nearly all the occipital and the greater part of the superior (behind the parietals) surfaces of the skull; the tympanics proportionally inflated, with large non-tubular orifice of meatus; the petrosals bullous, their apices in contact across the median line below the basisphenoid. Tympanics, mastoids, and parietals entering orbits. Occipital singularly reduced and narrowed, bent into three planes at right angles; supra-occipital bifurcate to inclose an interparietal; paroccipitals narrow, flange-like; basi-

\* Three special papers, substantially the same, differing in some particulars, viz.:-

"On a new Genus of Mexican Giltine Mammalia." < Ann. Mag. N. H. vii, 1841, pp. 521, 522. (The original notice; genus named on p. 521; species *D. phillipii*, same page.)

"On a New Giltine Animal from Mexico." < Rep. Brit. Assoc. Adv. Sci. for 1841, 1842, Trans. of the Section, p. 70. (Same orthography of name.)

"On a new Giltine Animal from Mexico." < Amer. Journ. Sci. and Arts, xlii, 1842, pp. 334, 335. (Editorial reproduction of the last; name *D. phillipii* on p. 335.)

† Special paper :-

"Macrocolinus, eine neue Nagergattung aus der Familie der Springer." < Arch. für Naturg., zwölfter Jahrg. Bd. i, 1846, pp. 172-173. (Species *M. haiticus* named, p. 173.)

occipital separated by a continuous fissure from petrosals. Mandible small, stout, with a very slight coronoid. (*b Dental*).—Superior incisors sulcate, connivent, pointing strongly backward; deeper than wide. Molars (pm. and m.,  $\frac{4}{4}$ ) simple, rootless. (*c. External*).—General form Jerboa-like; hind legs very long, saltatorial. Tail rather longer than head and body, penicillate. Soles densely furry. Feet with 1st digit rudimentary, but bearing a claw. Eyes large and full. Ears large, orbicular. Snout produced, acute, pilous, except the small nasal pad. Whiskers half as long as the whole body. Upper lip not cleft. Cheek-pouches ample. Pelage long and very soft. *Pictura* of body and tail bicolor. Size of a half-grown rat (*Mus decumanus*).

The skull of *Dipodomys*, whether taken as a whole or considered in several of its details, is of extraordinary characters not nearly matched outside the family to which it belongs. Many of its features are shared, to a greater or less extent, by *Perognathus*; but the unusual characters are pushed to an extreme in *Dipodomys*. The foregoing paragraph merely indicates the more salient peculiarities; the skull is described in full beyond. The enormous development of certain elements of the temporal bone, and the results of this inflation upon the connections of the bone, and general configuration of the skull, are the leading characteristics. With this is co-ordinated the reduction of the squamosal and occipital, and the curious shape of the latter, as well as the anomalous abutment of the thread-like zygoma against the tympanic, and the contact of the petrosals with each other. In *Geomyidae*, the temporals are of great size, but there is much less distortion of the topography of the parts, both squamosal and occipital maintaining ordinary characters. The temporal sinuses together are scarcely less capacious than the brain-cavity itself; the sense of hearing must be exquisitely acute, if co-ordinated with the osseous state of the parts.

Notwithstanding the singular condition of the skull of *Dipodomys*, resulting from the hypertrophy of certain parts and the reduction of others, the relations with that of *Geomyidae* are both close and clear; while *Perognathus* constitutes, in many respects, an excellent connecting link. Numerous coincidences could be pointed out showing how the hint afforded by the presence in these two families of ample external cheek-pouches is borne out in more essential features, notwithstanding the all but complete difference in general outward appearance.

*Description of the skull of Dipodomys.*—As in other cases, it will be found most convenient to consider the skull as a whole first, and afterward to examine its individual bones. An immature specimen is preferable for the latter purpose, though many or most of the sutures persist to extreme old age.

In many respects, the skull of *Perognathus* approaches or closely resembles that of *Dipodomys*, but the family peculiarities reach their extreme development only in the latter. Comparative expressions used in the following paragraphs are to be considered exclusive of *Perognathus*, unless the contrary is stated.

The skull is much depressed; elongated and acuminate in front; very broad behind, where the width is nearly two-thirds of the total length; and, viewed from above, presents in general a triangular shape, with the lateral angles completely rounded off, and a deep emargination in the middle of the base. Zygomatic arches scarcely come into this view at all; the width of the skull midway being much less than the intermastoid diameter. The outline of the zygomata is perfectly straight; between the turgid mastoid region and the expanded plate-like zygomatic process of the maxillary there stretches the thread-like malar, depressed to the level of the palate. The outline of the orbits is a quadrate notch between the saliences just mentioned. There is no interorbital constriction; were it not for the laminar zygomatic expansion of the maxillaries and the bullous mastoids, the space between the orbits would be the broadest part of the skull. The attenuate acuminate rostrum springs directly opposite the broad zygomatic part of the maxillaries, and extends beyond the incisors; it is at least one-third of the total length of the skull. The postero-lateral aspects of the skull present enormous bulging masses rounded and somewhat ovate—the extraordinarily developed mastoids. The same swellings constitute also nearly all the occipital region, the median line of which is a deep emargination. This character is perhaps unique; nothing like it is seen even in *Perognathus*; its peculiarity is on a par with the immense rostral development in a walrus for example. The resulting figure, as one author has aptly remarked, bears a ludicrously close resemblance to the buttocks of the squatting human figure, the mastoids being the nates, the emargination being the cleft between, and the foramen magnum having an obvious suggestiveness. The whole surface of the skull is smooth, and gently convex in all directions. There are no ridges or roughnesses; the

sutures persist plainly visible in adult life; and all the bones are remarkably thin and papery.

Viewed in profile, the skull shows notable features. The highest point is over the orbits, where the frontal and parietals are seen to be swollen; thence the superior outline sweeps gently down to the occiput, and in the other direction proceeds in a nearly straight—if anything, slightly concave—line to the tip of the snout. The great projection of the nasals beyond the intermaxillaries is well shown. The incisors in profile are seen to curve far backward as well as downward. The palatal outline is nearly straight, and declivous from before backward. Behind the palate, a small pterygoid hook is seen; but beyond this the whole outline is the inflated portions of the temporal bone hiding everything else. On the side of the rostrum midway, there is a large circular foramen, low down, but little above the palatal level; this is the orifice corresponding to the "anteorbital" foramen, here singularly displaced. From its fellow of the opposite side, it is only separated by a very thin vertical septum, apparently ethmoidal. This delicate partition, being often broken through in prepared skulls, has occasioned the statement of the intercommunication of the two foramina. But I find the septum complete and intact in some specimens, and although a vacuity may very possibly naturally occur, such does not appear to be the rule. The orbit appears as a subcircular fossa, largely roofed over in front by the thin expanded zygomatic plate of the maxillary, and bounded below by the malar. Independently of its laminar maxillary portion, the zygoma is a slender, straight thread down to the palatal level, and abutting behind against the tympanic. The actual suture is squamosal, of course, but there is a curious appearance of connection with one of the otic bones. In the general inflation of the posterior portion of the skull appears the large orifice of the meatus auditorius—a simple circular opening in the bullous mass.

Viewed from below, the general contour is substantially the same as that already noted from above; but many special parts claim attention. So great is the backward obliquity of the incisors that their faces show in this view with comparatively little foreshortening. The incisive foramina are a pair of contracted slits midway between the incisors and molars. The palatal surface in advance of the molars is much compressed; that between these teeth is broader and quite flat; its width posteriorly is little less than its length; it contracts somewhat anteriorly, where it is marked by a median ridge con-

tinuous with the septum between the incisive foramina. That part of the palate constituted by the palatal bones is marked with several minute foramina. The palate ends behind with a sharp median spur; on either side of this is an emargination, and external to this a large fossa perforated with two foramina anteriorly, and a third and much larger one behind. Beyond the palatals themselves, the walls of the posterior nares are continued by the pterygoids, which are small and hamulate, the hook abutting against the petrosals. Between the ends of the pterygoids, and right across the middle line of the skull, the apices of the petrosals meet each other, forming a bridge beneath the basiophenoid. The posterior parts of the skull, behind those already considered, are almost entirely occupied by the inflated elements of the temporal bone, between which lies the reduced basioccipital; this bone is narrowly acuminate, and is separated from the petrosals for its whole length by a continuous fissure, like that which, on the other side of the petrosals, separates these bones from the alisphenoid and squamosal. The foramen magnum appears partly in this view, flanked by the slight condyles, outside of which are seen the small, distinct, flange like paroccipitals.

The posterior view of the skull shows little but the inflated mastoids, with a cleft between, mostly occupied by the large foramen magnum, around which the contracted occipital bone appears as little more than the rim of this foramen.

All the bones of the skull, as well as those of the top already so described, are thin and light; and the base of the cranium is remarkable for its extensive vacuities. Not only are the petrosals separated from their surrounding by great fissures on either side, rendering it almost necessary to their stability that they should abut against each other at their extremities; but there is also a singular separation of the alveolar portion of the maxillaries from the superincumbent parts by a horizontal fissure, so that the palate appears as a sort of bridge between the fore and aft parts of the skull. Various peculiarities will appear more clearly from the following descriptions of individual bones.

The complex temporal "bone" will be first considered, since the prime peculiarities of the skull result from the singular condition of hypertrophy under which several of the elements of this bone exist. The topography of the parts and the connections of the bone are curiously remodelled, as a consequence of the enormous inflation of the various otic elements and corresponding reduction of the squamosal. In the absence of investigations into



the development of the temporal bone, I can only describe it as it appears in the adult animal, using the terms "mastoid", "petrosal", and "tympanic" in their current acceptation, without reference to the primitive otic elements. Respecting the squamosal, there is no difficulty; the petrosal appears under its usual condition of a bulla ossea. I regard as "tympanic" the inflated vesicle in which the meatus auditorius is pierced, which appears as a tubular prolongation of the bulla in the nearest allied family, *Geomys*. The rest of the inflation, forming the greater part of the occipital surface and much of the roof of the cerebral cavity, I shall simply designate as "mastoid".

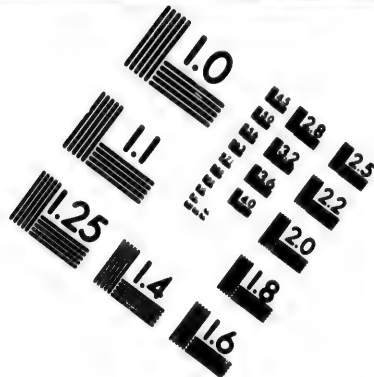
The two temporal bones together are little less bulky than all the rest of the skull. Excepting the reduced squamosal, all the elements are subjected to extraordinary inflation, as well as peripheral enlargement; they appear as papery vesicles, light, thin, and smooth, without ridges or angles, inclosing extensive antra, the collective capacity of which is scarcely less than that of the whole brain-case. These vaulted walls are supported by delicate bony arches or trabeculae within, and imperfectly partitioned into several cavities by thin septa. The mastoid constitutes the greater part of these bulging masses. Its backward protuberance occupies nearly all the occipital surface of the skull on each side, the occipital bone being reduced to a narrow margin of the foramen magnum, sunk in an emargination between the mastoid and its fellow. On the top of the skull, the mastoid similarly expands, filling the whole of the area usually occupied by the squamosal, and forming the greater part of the roof of the brain-case. Thus we have the curious circumstances of extensive mastoideo-occipital suture on top of the skull, and still more prolonged mastoideo-parietal suture—for the whole of the longest side of the right-angled parietal articulates with the mastoid; while so great is the anterior prolongation of this same bone, that a small part of it fairly enters the orbit at the back outer corner of the latter. This extensive line of sutures with squamosal, parietal, and occipital bones, respectively, is distinct throughout; but the boundaries of the mastoid with other otic elements can only be inferred by certain lines of impression which appear to mark it off from petrosal and tympanic. Another point is to be considered here: the flattened and entirely superior portion of the mastoid (that which lies in the ordinary site of a squamosal) is incompletely distinguished from the occipital portion of the same bone by a line of impression running straight across from the margin of the meatus auditorius to the median line of the skull; and this

mark corresponds to a nearly complete bony wall within the bone, which partitions off one sinus from another. This may be hereafter found to indicate the respective parts which certain primitive otic elements take in the formation of the "mastoid".

The petrosal, *i. e.*, the bulla ossea, is less peculiar than the mastoid; it is not more inflated than in very many mammals, and is chiefly remarkable for its contact with its fellow, and for the extensive uninterrupted fissures which separate it both from basioccipital and alisphenoid. In general shape it is conoidal, moderately swollen, with the apex of the cone produced, and curiously curved toward the median line of the skull, where it meets its fellow, forming a bony bridge beneath the basisphenoid. The claw of the hamular pterygoid rests against the end of the petrosal; and close to this there is an abutment of a piece of the sphenoid; otherwise, there is a great fissure betwixt it and the sphenoid. It is only in contact with occipital elements by means of the flange-like exoccipitals; the whole extent of the basioccipital being separated, as just said, by a large fissure. Posteriorly it is confluent with the mastoid, with imperfect indication of the precise line of union; exteriorly it is continuous, without appreciable indication of original distinction with the special inflation in which the meatus is situated. This papery vestibule I presume to be analogous with the tubular meatus externus in *Geomys* and elsewhere; the orifice is large, subcircular, and simply a hole without raised brim, pierced in the back upper corner of the bulb. Anteriorly the tympanic bulges so far as to form part of the orbit. While this special inflation is not otherwise distinguished from the general bulla ossea than by a slight constriction, it is remarkably divided off, above and behind; from the mastoid, by a strong line of impression, of which I shall say more presently.

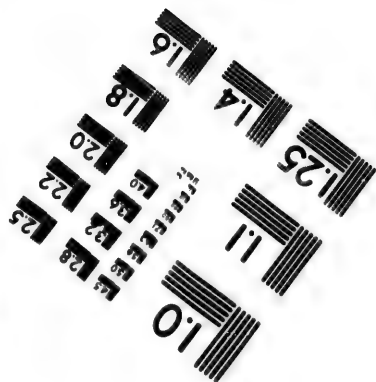
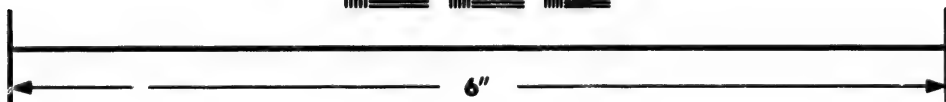
Coincidentally with the hypertrophy of these otic elements of the temporal, the squamosal is peculiarly reduced in extent, and pushed into the orbit, to which it is almost entirely restricted. It is simply a small irregularly shaped plate of bone lining the back part of the orbit, with a slight spur just exceeding the orbital brim in a little notch between corners of the frontal and parietal bones. The squamosal remains long discrete from all its surroundings. In full-grown though youngish animals, the squamo-sphenoidal sutures may be readily traced—that with the alisphenoid just below the glenoid cavity, that with orbito-sphenoid within the orbit. The zygomatic





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- 1.0
- 1.1
- 1.25
- 1.4
- 1.6
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process of the squamosal is of peculiar character; instead of a slender curved spur reaching around to grasp the malar, there is a short abrupt heel appressed against the tympanic, and to the roughened face of this heel the clubbed end of the needle-like malar is affixed. The relation of the parts is such that the zygoma appears to articulate behind with the tympanic—it actually has an abutment against that bone, though no real articulation with it.

From the lower back edge of the squamosal, a curious thread of bone starts off and occupies the deep groove already mentioned as separating the tympanic from the mastoid. No break from the squamosal can be seen in this thread, which curls around the orifice of the meatus, still in the groove mentioned, and ends by a slightly enlarged extremity below and behind the meatus, exactly in the position of an ordinary "mastoid process". I am uncertain of the meaning of this. The end of this ligule or girdle of bone thus encircling the tympanic is in the site of the postero-lateral angle of the skull in *Geomys*, in which such angle is formed by a corner of the squamosal; and the inference is self-suggestive that this delicate bony strap may really be squamosal—an edge of the squamosal persisting in situ after the rest of that bone has been crowded down into the orbit by the encroachment of the mastoid. Such a view, however, will bear further scrutiny. Even if a slender spur of actual squamosal does run out into the tympano-mastoid groove, it does not follow that the whole of the fold in this groove is squamosal; and certainly the enlarged extremity of this ridge, behind the meatus, has every appearance of an ordinary mastoid process.

Next after the squamosal, the occipital bone suffers most from the enlargement of the otic elements; it is singularly restricted in extent, and presents itself in unique shape, compressed between the swollen mastoids. All the lateral occipital suturation is with the mastoid, excepting the basioccipital. The occipital lies in three planes, nearly at right angles with each other. The basioccipital is horizontal, as usual, upon the floor of the skull; the exoccipitals, with probably part of the supraoccipital, are perpendicular behind; the rest of the supraoccipital is horizontal again, on top of the skull. The basioccipital is wedge-shaped, and offers nothing very peculiar, excepting its entire disconnection from the petrosals, between which it lies; its sphenoidal articulation is just behind the joined apices of the petrosals. Exoccipitals appear as a pair of flaring flange-like processes, just outside the condyles, appressed against the otic capsules. The foramen is very large,

subcircular, and mostly in the perpendicular plane of the bone. After inclosing this orifice, the bone rapidly contracts as it rises to the top of the skull; this part is marked with a sharp perpendicular median ridge, and the edges of the bone being affected in coming into apposition with the swelling mastoids, there results a pair of deep narrow fossæ upon the face of the bone. The portion of the supraoccipital which mounts the top of the skull to there lie horizontal, almost immediately forks to embrace a small shield-shaped interparietal bone between its prongs. The ends of these prongs touch posterior corners of the parietals.

The sphenoid bone is of rather small extent, owing to the situation of the squamosals in the orbit. It is widely fissured from the petrosals. The alisphenoid is very short; its termination may be seen in the jagged suture with the squamosal; but short as it is, it only misses taking part in the mandibular articulation, since it extends to the margin of the glenoid. The orbito-sphenoid is comparatively smaller still, the place it occupies in *Geomyiids* for instance being here largely occupied by the squamosal. The sphenopalatal suture may be traced in young specimens with a zigzag but still in general transverse course, from the side a little behind the maxillary alveolus across the middle line of the skull. There is no vertical orbital plate of the palatal bone; it all lies flat, and extends forward on the palate, wedge-shaped, but with square termination to a point opposite the first true molar. A backward spur of this bone forms with its fellow a sharp median process. There are various foramina already noted. The pterygoids are small claw-hammers abutting at their extremity against the petrosals.

The parietals are nearly right-angled triangles, with one side of mutual apposition along the median line of the skull, another transversely articulating with the frontal, and the hypotenuse postero-exterior, for the mastoid suture. The back corners meet the prongs of the occipital and slightly embrace the interparietal. The outer corner is prolonged into a spur which attains the brim of the orbit. And here, the remarkable construction of the orbit by an unusual number of bones, may be noted. Following the brim of the orbit around we find—zygomatic process of maxillary; lachrymal; frontal; spur of parietal; back upper corner of squamosal; front end of mastoid; fore bulge of tympanic; zygomatic heel of squamosal; whole of malar, and as back to maxillary.

The portion of the frontal which appears on the surface of the skull is

keystone-shaped and straight, broad behind to articulate with both parietals, narrowing anteriorly with nearly straight edge, and in front irregularly transverse to accommodate its several rostral sutures. It sends a sharp spur on either hand into a recess between the maxillary and intermaxillary, and each intermaxillary causes a shorter, more obtuse re-entrance; the middle part articulating with the nasals is transverse. The orbital portion of the frontal is a simple plate suturing behind with the orbito-sphenoid and squamosal, and in front with maxillary and lachrymal. The latter is of considerable extent, and much excavated; its edge appears upon the surface of the skull, margining the back of the zygomatic process of the maxillary.

The malar is very peculiar. In allied Rodents, this bone is a stout arch, and very short, in consequence of the close approximation of the ends of the zygomatic processes of both maxillary and squamosal. But here there is, to all intents, no such squamosal process, and that of the maxillary ends abruptly; so the malar is a long bone, to complete the arch; it is a straight rod, of thread-like tenuity, with the fore end slightly elbowed and sharpened to lie by oblique suture against the maxillary, on the inner side, and the hind end slightly clubbed to suture by a roughened flat surface with the heel of the squamosal; and such are the relations of the parts that the malar seems to run against the otic capsule. The depressed position of this bone, which lies down on the level of the palate, has been already noticed.

The maxillary bone, with a general shape and connections which scarcely require notice, has two peculiarities; one of these is the singular position of the "ante-orbital" foramen—here a large circular perforation at the anterior border of the side of the bone, altogether remote from the orbit. It lies above and even in advance of the incisive foramina. Its fellow is only separated by the width of the compressed muzzle; there is a thin partition, probably ethmoidal, between them. The other peculiarity of the maxillary is the unusually extended and vaulted zygomatic plate, which thus roofs over a considerable part of the orbit. This inflated lamina suddenly comes to a point where the malar joins it. Its suture with the frontal, or the surface of the skull, is a straight line.

The incisive foramina, in *Geomyidae*, are wholly in the intermaxillaries; in *Dipodomys* they are formed by both bones, the maxillaries bounding about a third of their periphery. The nasal spur of the intermaxillary extends upon the forehead a little way beyond the ends of the nasals; while a sharp pro-

cess of the frontal separates it from the maxillary. The alveolar portion is remarkably curved backward, to suit the trend of the incisors, and a strong alveolar plate separates the teeth for about half their length.

The nasals are chiefly notable for their length and tenuity; they reach far beyond the incisors; the back half is linear and superficial; anterior to this, where the intermaxillaries bend down, the nasals become somewhat volute, prolonging a semi-tubular snout. Within, delicate turbinal scrolls are seen extending to the orifice. The nasals are supported, nearly to their ends, by small intermaxillary spurs.

The mandible remains for consideration. This bone is remarkably small, considering the size of the rest of the skull, and is further notable for its slight elevation posteriorly, its short incomplete symphysis, and the thickness of the body of the bone. The coronoid process is remarkably small, not nearly attaining the level of the condyle, at the root of which it appears as a minute, backward sloping, prickle-like spur. The condyloid ramus itself is small, compressed, and oblique. The principal feature of the bone is an immense flaring lamina, which arises upon the back part of the lower border of the body of the bone, and expands obliquely outward and upward, with a peculiar twist. This plate-like process is longer than the condyloid ramus itself, and ends in an acute point, so that the back of the jaw appears two-pronged. There is a deep pit between the alveolus and the root of the coronoid plate. The mental foramen is conspicuous upon the outside of the jaw close to the incisors. The small size and lowness of the jaw is seen in the peculiarly retreating chin of the species; and it is probable, to judge especially from the condition of the coronoid, that the biting power is comparatively slight.

The vertebral formula of *Dipodomys ordii* is given by Baird as 7 cervical (with anchyloses of 3d, 4th, and 5th), 12 dorsal, 9 lumbar, 4 sacral, and 28 caudal, = 60; there is doubtless an individual variability of several of the caudal segments. There are five metacarpals and metatarsals, though the inner one of each is reduced. There are perfect clavicles. The tibia and fibula are united below.

*Dentition of Dipodomys.*—The dentition of *Dipodomys* is simple. Of the four grinding-teeth above and below, the anterior one is a premolar, being preceded by a deciduous tooth, which, however, is long persistent. This one is rooted and with a more complicated crown than the rest; the molars

proper are rootless and perennial. In both jaws, the set of the molars is very oblique; in the upper, the anterior tooth bends strongly backward, and the posterior one somewhat forward, thus bringing their crowns in close apposition, though their roots are divergent. It is the same in the lower jaw, though the greatest obliquity there is in the strong forward set of the posterior tooth. The teeth are all simple, compressed prisms, broader in the transverse than in the fore and aft direction. In the worn state, the crowns of the two intermediate molars are simply elliptical; that of the anterior molar is rather a spherical triangle, with convex posterior and two concave anterior sides; the back molar is small and subcircular. It is much the same in the lower jaw. The crowns show simply the brim of enamel, with a depressed island of dentine. In the unworn state, however—such as may be observed in specimens with the milk-tooth still in position—there are some decided differences. The outer border of the two anterior teeth shows a deep nick, where there is a re-entrant fold of the enamel; and the back molar has a similar indentation of the inner side. This diminishes regularly with the continuous growth of the incisors, until the crowns are ground down beyond the extent of the infolding, when it ceases to appear and the plain elliptical form of the crown is assumed.

The incisors are small and delicate in both jaws, contrasting with the stout scalpels of *Geomyidae*. The superior pair are much compressed, being narrower than deep, and strongly curved. Their face is marked by a deep median groove, and the outer portion is rabbeted away, so that the groove is visible in a profile view. The teeth emerge from the sockets some distance apart, separated by an intervening alveolar plate, but they are convergent, and their tips are in close contact. The under incisors, no larger than the upper ones, are of much the same general character, but are not grooved, the smooth faces being simply rounded off. Their roots make a slight protuberance at the outside of the base of the condyloid ramus.

*External characters of Dipodomys.*—The general configuration of this animal is lithe and graceful, indicating agility and incessant activity. The body is slender, the neck distinct; the head large, with tapering muzzle; the eyes and ears are prominent; the fore limbs small and neat, indicating predominance of prehensile over merely gressorial faculties; the hinder limbs are of great size, as perfectly saltatorial as those of a Kangaroo or Jerboa; and the tail is longer than the body. Notwithstanding the saltatorial nature of

the animal, there is none of that preponderance of organization of the hinder parts witnessed in the Kangaroo, with its massive haunches and enormous tail; the whole body is equally slender, the leaping power being manifested in the enlargement of the hind limbs alone; the tail, too, is slender throughout.

The head is distinguished from the body by a well-defined cervical constriction. The broad high occipital region dips suddenly down to the nape. The upper corners of the head, upon which the ears rest, are elevated and wide apart; the top of the head has in general a triangular shape, tapering from each ear to the snout with but slight swelling in the orbital region, and is quite flat across, with the most gentle longitudinal curve in the frontal region, and nearly straight nasal profile. The muzzle is acuminate and much produced, appearing longer still in consequence of the remarkably small retreating chin. The muzzle is entirely hairy, excepting a small nasal pad; this shows a median depression, but there is no cleft of the upper lip, the whole of which is thickly clothed with stout hairs, that form a dense fringe drooping over and concealing the superior incisors. The lower lip is thickened and densely hairy; and there is also a hairy commissure of the upper lip *behind* the superior incisors, so that these teeth are shut out of the true (mucous-lined) buccal cavity. For the rest, the lips seem to come together vertically instead of horizontally, closing the oral aperture sideways, though of course the buccal cavity or mouth proper shuts as in ordinary mammals. All this is essentially the same as in the *Geomyidæ*; and further, as in these last, there is a great pouch on each side of the head, entirely disconnected with the mouth, formed of a duplication of ordinary integument, hairy throughout. These sacs will admit the first joint of one's little finger; they run the whole length of the head, but not beyond to the shoulder. In relative capacity, they about equal the least developed pouches of *Geomyidæ*—those of *Geomys hispidus* for instance. The opening is crescentic; the inner limb of the semilune being the skin of the jaws, while the outer limb is a free fold or border arising on the side of the snout half-way between nostrils and incisors and a little back of both, and curving loosely around to the side of the under jaw near its middle.

The whiskers are extremely numerous, and some of them are very long. A bunch of short fine ones springs from the extremity of the snout, on each side, by insensible lengthening of the fringe of hairs that clothe the upper lip. Others grow in the usual site, and the longest of these usually exceed



half the total length of the body. There are other long, slender, bristly hairs in weak clumps about the eyes and ears, and a bunch of short antrorse bristles springs from the chin. The eyes are large and prominent, in life remarkably soft and expressive, in striking contrast to the small and inconspicuous eyes of the *Geomyidae*; in consequence of the production of the muzzle, they are situate much nearer to the ears than to the nose, and rather above a line connecting the two. The ears, similarly, are large and "leafy", appearing the more prominent because they rest upon the most protuberant part of the skull. When pressed out flat, the auricle is nearly orbicular. In the natural state, the fore border is largely folded over, the duplication extending from the extreme root to the highest point of the ear, and representing about one-third of the width of the ear. This fold causes a slight pointing of the ear. The posterior border is more rounded than the anterior; and within its base is developed a large, conspicuous, obtusely-angular antitragus, so broad that its inner edge is extensively overlapped by the fold of the anterior border of the auricle; a fringe of long hairs springing from the base of the anterior fold is directed backward over the antitragus; otherwise the auricle is closely and completely pilous on both sides, the hairy clothing of the open part of the concavity being heavier than that on the back of the ear.

The fore limbs are shortened, in sacrifice of locomotive ability to increase of prehensile faculty. The arm and fore arm are stout; the latter tapers very abruptly and contracts to a delicate wrist and very small hand. There are four perfect digits, and a rudimentary thumb; the longer digits rather exceed, even excluding their claws, the length of the hand proper (metacarpus); the 3d and 4th are approximately equal in length and longest; the 2d and 5th are successively reduced a little in length; the 1st is a mere stump; its claw is a knob; the other claws are well formed, slender, compressed, acute, little curved, nearly as long as their respective digits. The back of the whole hand is pilous, and longer hairs fringe the sides of the digits; but the palm is naked, minutely tubercular throughout, these numberless little elevations showing no recognizable special distribution. The hand ends behind with an enormous smooth bulb, a little to the inner side, and with a smaller external bulb, likewise smooth, separated from the main one by a narrow hairy interval.

The hinder limbs offer the opposite degree of development. While the fore, from the elbow outward, is only a fourth of the total length, the corre-

sponding measurement of the hind limb, that is, from the knee outward, is three-fifths or more of the whole length, and the hind foot alone is about one-third of such dimension. There is no noticeable bulkiness of the haunches, but the hams are massive, flattened-conoidal, suddenly contracting at the lower third, where the crus is of much less calibre than the foot. There is a prominent heel, and an obvious tendo Achillis. The metatarsus is subcylindrical, widening to a broad foot with strong digits. The whole foot reminds one of a rabbit's; a resemblance heightened by the dense furring of the whole sole, excepting a small calcaneal tuberosity. There are four perfect digits, of which the 3d is the longest, the 4th and 2d are successively a little shorter, and the 5th is much shorter still; while the 1st is a mere rudiment, entirely removed from the rest, nearly half way up the foot. This bears a stumpy claw; the other claws, though small, are well formed, stout at base, compressed, little curved, and acute.

The tail exceeds the head and body in length, even without the penicillate tuft of hairs at the end, which projects an inch or more beyond the vertebrae. It is of somewhat quadrangular shape, the flattening being especially appreciable on the under side, and is of nearly uniform calibre throughout, springing directly from the body without any basal enlargement, and but little taper at the end. It is closely and uniformly clothed with rather stiffish hairs for most of its length, the hairs gradually lengthening on the further half into the well-formed terminal brush.

The pelage differs from that of the allied genus *Perognathus* in its softness, length, and fineness, and has a silky gloss in life. It also lies with extreme smoothness on the colored areas of the body; the hairs are plumbeous basally, as usual; on the white parts they are unicolor to the roots.

In the male, during the rutting season, there is an immense perineal enlargement, strictly circumscribed from neighboring parts, due to the turgidity of the virile organs within. The anus presents in the centre of this enlargement with the sheath of the penis just in front, quite prominent. There is a comparatively large os penis. In the female, the anal and genital orifices are in still closer relation; the ostium vaginæ is prolonged in front into a dependent lobe, occupying the site of the penial sheath of the male.

The pattern of coloration of *Dipodomys* is peculiar and diagnostic of the genus—the striped tail and white band across the hips are not found elsewhere. All the upper parts are fulvous or tawny-brown, closely lined with

fuscous to a greater or less extent and intensity. Some specimens, with the least dusky, are very light colored—a pale yellowish-cinnamon; others approach mouse-color, but even in the darkest specimens the decided fulvous shade appears at least upon the sides. All this colored portion is plumbeous beneath, excepting a little space along the middle of the sides, where basally white hairs have the tawny tips. All the under surface of the animal is snow-white to the roots of the hairs. The line of white begins on the side of the muzzle and runs along the side of the head, including the pouch; the entire fore limb is white; the stripe rises a little on the side of the belly, and thence runs along the middle of the outside of the hind limb from the knee to the heel, sending a sharp white stripe from the knee across the haunches to the root of the tail. The hind foot is white, with a dusky stripe along the sole. The whiskers are partly black, partly colorless; their conjoined bases make a conspicuous black spot on each side of the muzzle. There is some whitish-ness in most cases—sometimes altogether wanting—about the eye; and a white patch just back of the ear. The front of the ear is sometimes light. The tail is dusky-slaty, or sooty-brown, or even blackish, with a broad, firm, white stripe on each side from base to near the tip. At the extreme base, the white usually encircles the tail; at the other end, the color of the tuft is altogether indeterminate; sometimes the white lateral stripes give out before reaching the end, leaving the tip entirely dark; sometimes the white extends to the very end of the brush, cutting off the dark altogether; and, moreover, the white may encroach upon the under side, cutting off the dark from more than half the tail; oftener, the brush is mixed dusky and white. Thus the tail may end either white or dark, or a mixture of both. It is as variable in this respect as the tail of a skunk. The eyes are lustrous black; the nose-pad and palms flesh-colored; the claws pale.

In old museum specimens, long exposed to the light, the above description may not be veridical as regards any of the darker markings and shades mentioned; for all the colored portions of the fur finally fade to a dull, pale brownish-yellow, or even dingy yellowish-white. Under such circumstances, even the rich purplish-chestnut of a mink, for example, ends in dingy whitish.

*Discussion of the species of Dipodomys.*—Having thus fully exposed the characters of the animals of this genus, it remains to consider the mode in which, and extent to which, the genus has become differentiated into recognizable forms, if there be more than one. Various species have been pro-

posed and recognized. As they rest mainly upon size and proportions, these points will be first discussed.

The following tables of measurements of a series of *Dipodomys*, fresh and alcoholic, will serve to show whether or not two species, commonly supposed to be distinguished by size and proportions, intergrade in these respects. The specimens are arranged without reference to locality, according to the chief point in question, namely, length of tail.

TABLE V.—Measurements of seventeen specimens of *DIPODOMYS*.

Carnegie number (After Smith's list.)	Locality.	Sex.	From tip of nose to—					Tail to end of—		Length of—		Nature of specimen.
			Eye.	Nose.	Occiput.	Tail.	Vertebrae.	Hairs.	Fore foot.	Hind foot.		
4370	Cape St. Lucas.....	♂	0.80	1.45	1.55	3.50	5.00	.....	1.35	Alcoholic.		
4338	Fort Whipple, Ariz.....	♂	.....	1.00	4.25	5.00	6.00	.....	1.55	Fresh.		
4371	Cimarron, N. Mex.....	♀	1.00	1.55	1.75	4.50	5.00	5.75	1.55	Alcoholic.		
4370	Cape St. Lucas.....	♀	0.85	1.35	1.45	3.50	5.25	.....	1.40	.....do.		
5337	Fort Whipple, Ariz.....	♂	.....	.....	4.50	5.25	6.25	.....	1.50	Fresh.		
5470	(Unknown).....	♂	1.00	1.40	1.55	4.75	5.50	.....	1.40	Alcoholic.		
4370	Cape St. Lucas.....	♀	0.85	1.40	1.50	3.75	5.75	6.75	1.40	.....do.		
4370	.....do.....	♂	0.85	1.50	1.60	3.75	5.75	6.75	1.40	.....do.		
4370	.....do.....	♂	0.90	1.45	1.55	3.75	5.75	6.75	1.45	.....do.		
7340	(Unknown).....	.....	.....	.....	5.75	6.00	.....	.....	1.40	.....do.		
7344	Platte Valley.....	♀	0.90	1.40	1.60	4.50	5.75	7.00	1.35	.....do.		
3007	Fort Randall, Cal.....	♂	0.90	1.35	1.55	3.25	5.50	.....	1.40	.....do.		
3008	.....do.....	♂	0.90	1.35	1.40	3.25	6.00	.....	1.40	.....do.		
3008	"California".....	.....	.....	.....	5.00	6.10	7.00	.....	1.40	.....do.		
10725	Monterey.....	♂	1.00	1.60	1.75	5.00	6.75	7.75	1.70	.....do.		
7348	Fort Tejon, Cal.....	♀	1.00	1.60	1.80	4.25	7.00	7.75	1.70	.....do.		
.....	"Rocky Mts.".....	♀	0.90	1.45	1.70	4.50	7.00	8.00	1.70	.....do.		
Average.....			0.90	1.44	1.61	4.66	5.70	6.85	.....	1.58		

The foregoing table of measurements of only 17 specimens, all adult, suffices to prove an uninterrupted gradation in size of every part of the body and its members. There is no break whatever in any of the absolute dimensions. The specimens range, by minute fractions of the inch, from 3.25 to 5.00 inches in length of head and body, averaging about 4.00. The tail vertebrae range from 5.00 to 7.00 inches, averaging about 5.75; with the hairs, the tail is from 5.75 to 8.00 inches, averaging a little less than 7.00. The hind foot runs from 1.35 to 1.70, settling at an average of 1.58. It will be observed that the lengths of tail and feet bear no constant ratio to each other, some specimens with relatively smallest feet having relatively the longest tails. It will further be evident that absolute lengths of tail and feet are not indicative

of geographical limitations; for the specimens which are arranged in the table with reference to absolute length of tail vertebræ (with which absolute length of feet is approximately correspondent) show complete intermixture of localities. Measurements of a hundred or a thousand specimens would, of course, only tend to place these facts in stronger light. It may be safely stated as a fact, then, that differences in absolute size, either of the body or of any of its members, are not available for distinction of two species; and, furthermore, that no set of absolute dimensions is correlated with geographical distribution.

Nevertheless, one cannot fail to be struck, in examining the table, with the extraordinary discrepancy in *relative* length of the body and tail. In No. 4871, for example, the tail (vertebræ) is only half an inch longer than the head and body (4.50-5.00); that is to say, it is but *one-ninth* of the head and body length longer. In No. 2626, the tail is two and three-quarter inches longer than the head and body; that is to say, almost *twice* as long. It would appear improbable that such unusual difference as this should not signify something more than mere individual variability. In order to discover whether or not the *proportionate* (as distinguished from absolute) dimensions of body and tail may not lead to some tangible result, the following table is constructed, in which the same specimens are arranged geographically. It is necessary to exclude four of them, however—Nos. 2478, 7349, from unknown localities, together with the two respectively marked "California" and "Rocky Mts.," as I have reason to believe that these indications of locality are not reliable.

TABLE VI.—Measurements of thirteen specimens of DIPODOMYS.

ROCKY MOUNTAIN REGION.				PACIFIC COAST REGION.			
	Head and body.	Vertebrae of tail.	Hind feet.		Head and body.	Vertebrae of tail.	Hind feet.
Arizona.....	4.25	5.00	1.25	Cape St. Lucas.....	2.50	5.00	1.25
Do.....	4.50	5.25	1.50	do.....	2.50	5.25	1.40
New Mexico.....	4.25	5.00	1.25	do.....	2.75	5.75	1.00
Platte Valley.....	4.50	5.75	1.50	do.....	2.75	5.75	1.00
				do.....	2.75	5.75	1.45
				Fort Reading, Cal.....	2.25	5.00	1.00
				do.....	2.25	5.00	1.00
				Monterey.....	5.00	6.75	1.70
				Fort Tejon, Cal.....	4.00	7.00	1.70
Averages.....	4.43	5.25	1.53		3.75	5.50	1.51

This second table, as far as it goes, leads to some tangible and practical results. More specimens would undoubtedly modify the exact figures, but would, I think, only confirm the general statement, that there is a decided difference in relative length of head and body and of tail between specimens from the interior and those from the coast region—just as there is in the genus *Cricetodipus*. This substantiates, in effect, the broad distinction established by Baird in 1857, though the details given by that author require qualification.\*

In the animals from the interior, with an average length of nearly 4.50 inches, the tail is scarcely or not an inch longer than the body; that is to say, it is about one-fourth as long again as the head and body.

In the coast region specimens, with an average length of less than 4 inches, the tail is about 2 inches longer than the head and body; that is to say, it is, if anything, more than half as long again as the body.

The feet do not present any very tangible characters. We find them of all sizes, coupled with different extremes of tail length. Nevertheless, it will be observed that the Cape St. Lucas specimens alone of the coast series present small feet, under 1.50; and that, without these, the coast series would show a length of foot of 1.60–1.70, thus correlated with the greater length of tail.

To these data may be added some others, tending to substantiate a difference between the two forms of the genus. The western animal averages smaller and of more slender build, with larger ears and longer limbs, and especially longer tail. It is darker in color, the prevailing tone being a mouse-brown, overcast with tawny or fulvous. The animal from the interior is larger, and noticeably more stoutly built, with smaller ears and shorter limbs, and particularly shorter tail. It is lighter in color, prevailing tone being the

\* Mamm. N. Am. 1857, p. 409.—“Whatever the number of species, all hitherto detected in North America belong to the two following sections:—

“Section I. Hind foot not exceeding 1.50 inches, usually appreciably less; about one-third the length of head and body. Tail vertebra about  $1\frac{1}{2}$  times the length of head and body in nature; rarely exceeding 5 inches, never  $5\frac{1}{2}$ . *D. ordii*.

“Section II. Hind foot, 1.60 inches, sometimes more; always considerably exceeding 1.50; almost half as long as head and body in the first specimen. Tail vertebra  $1\frac{1}{2}$  times the length of head and body, always exceeding  $5\frac{1}{2}$  inches; usually from 6 to 7 inches. *D. philippi*, *D. agilis*.”

The proportions of body and tail here laid down I verify exactly, though the limits of extremes given require to be enlarged. On the contrary, the statements made respecting the feet do not hold, upon examination of more material. In fact, the Cape St. Lucas are the shortest-footed animals of the whole series; and in one very large Texas specimen (dry), not given in the table, the foot is almost 3 inches long.

peculiar tawny or fulvous of the genus, deepened somewhat on a dorsal area with mouse-brown.

These are simply observed matters of fact, not open to question. Certain differences which actually exist, as well as the insensible blending of these differences, may both be fairly signalized by the following formulæ of nomenclature and description, in which the various names which have been proposed are relegated to their proper place, covering diagnosis of typical (*i. e.* extreme) characters, and indication of the region in which such form more especially prevails:—

### DIPODOMYS PHILLIPSI,\* Gray.

Phillips's Pocket-rat; "Kangaroo Rat".

- Dipodomys phillipsi*, GRAY, Ann. Mag. N. H. vii, 1841, 541; Rep. Brit. Assoc. Adv. Sci. for 1841, 1842, Trans. of the Sections, 70. Real del Monte, Mex. (Type of genus).—WAGN., "Suppl. Schreb. iii, 1843, 296."—LEW., Proc. Acad. Nat. Sci. Phila. vi, 1853, 224. (Sacramento Valley, Cal.)—GIBB., Säug. 1855, 600. (Compiled.)—BAIRD, M. N. A. 1857, 412. (California, &c.)—COOP. & SUCKL., P. R. R. Rep. xii, 1859, Mamm. 100, 137.
- Dipodomys phillipsi*, GRAY, Am. Journ. Sci. xlii, 1843, 335; List. Mamm. Br. Mus. 1843, 120.—GIBB., Cat. Bones Br. Mus. 1862, 173.—GRAY, Proc. Zool. Soc. 1863, 200.
- Dipodomys phillipsi*, SCHIEZ, Syn. Mamm. ii, 1845, 93. (Compiled from Gray.)
- Dipodomys phillipsi*, AUD. & BACH., Q. N. A. iii, 1853, 137, pl. 130. (From Gray's type.)
- Dipodomys phillipsi*, BAIRD, P. R. R. Rep. x, 1859, Williamson's Route, Mamm. 82. (Pecos Creek, Cal.)
- Dipodomys phillipsi*, COUES, Proc. Phila. Acad. 1875, 395.
- Macroctes huttoni*, WAGNER, Arch. f. Naturg. 1846, 176; "Abb. K. Bayer. Akad. xxii, 1848, 319, pl. vii".—GIBBEL, Säug. 1855, 609. (Compiled.)
- Dipodomys agilis*, GAMB., Proc. Acad. Nat. Sci. Phila. iv, 1848, 77. (Los Angeles, Cal.)—GAMB., Ann. Mag. Nat. Hist. iii, 1849, 318 (same).—LEW., Proc. Acad. Nat. Sci. Phila. vi, 1853, 224.—AUD. & BACH., Quad. N. A. iii, 1854, 339. (Compiled.)—GIBB., Säug. 1855, 600. (Compiled.)—BD., Proc. Acad. Nat. Sci. Phila. 1855, 334 (San Diego, Cal.); M. N. A. 1857, 414, pl. 9, f. 1.—GRAY, P. Z. S. 1868, 201.
- Dipodomys heermanni*, LEW., Proc. Acad. Nat. Sci. Phila. 1853, 224. (Sierra Nevada.)
- Dipodomys heermanni*, BAIRD, Mamm. N. Am. 1857, 415. (Compiled.)
- Dipodomys heermanni*, GRAY, P. Z. S. 1868, 201. (Compiled.)
- Dipodomys wagneri*, LEW., Proc. Acad. Nat. Sci. Phila. 1853, 224.—BD., M. N. A. 1857, 415. (Compiled.)—GRAY, P. Z. S. 1868, 201. (Compiled.)

**HABITAT.**—Pacific region at large, from Washington Territory to Cape St. Lucas; Nevada; and portions of Mexico (Real del Monte, *Phillips*). Specimens examined from Fort Walla-Walla, Cape St. Lucas, and numerous localities nearly throughout Upper and Lower California.

\* This name is found variously spelled by authors, as well as by Gray himself; but if, as stated by Gray, the species was named after John Phillips, the rendition here adopted appears to be correct.

† Special paper: Description of Two New Californian Quadrupeds [*D. agilis* and *Mos californiensis*]. < *tem. cit.* pp. 77, 78. (Also, Ann. Mag. Nat. Hist. *tem. cit.* pp. 318, 319, with some literal modification of title.)

‡ The ascribed locality is unquestionably erroneous. The label "James Reed, South Carolina", like that on some other specimens of various animals I have seen, indicates the donor and his residence.



**CHARS.**—Small: rather under than over 4 inches in length of head and body, with slender shape, large ears, long limbs, and especially long tail. Tail vertebrae 2 inches (more or less) longer than the head and body, bearing a proportion of about (rather more than less) 1.50 to 1.00. Coloration heavy: upper parts rather dark mouse-brown or even dusky in general tone, lightened, especially on the sides, with the peculiar tawny shade of the genus.

This animal served as the type of the genus described by Gray in 1840. It figures in various treatises, mainly under compilation. Audubon gave an excellent illustration, taken from the type-specimen. *Macrocolus halticus* of Wagner,\* described soon afterward, is undoubtedly, as suggested by both Gray and Baird, the same animal, though no mention is made of the pouches. Some other unquestionable synonyms are cited above.

#### DIPODOMYS PHILLIPSI ORDI, Woodh.

Ord's "Pocket-rat"; "Kangaroo Rat".

*Dipodomys ordii*, "WOODH.", *Proc. Acad. Nat. Sci. Phila.*, vi, 1853, 324. (Notice of Woodhouse's type).—WOODH., *Proc. Acad. Nat. Sci. Phila.*, vi, 1853, 335.—WOODH., *Siggr. Rep. Expl. Zool. and Col. E.* 1853, 50, pl. 4. (El Paso, Texas).—AUD. & BACH., *Q. N. A.* iii, 1854, 317. (Compiled).—BAIRD, M. N. A. 1857, 410, pl. 5, f. 1; pl. 51, f. 1; pl. 51, f. 1, 2.—BAIRD, P. E. R. Rep. x, 1859, Gunnison's and Beckwith's Route, Mamm. 8.—BAIRD, P. E. R. Rep. x, 1859, Whipple's Route, Mamm. 14.—HAYD., *Trans. Amer. Phil. Soc.* xii, 1868, 147. (Niobrara R.).—GERR., *Cat. Bones Br. Mus.* 1868, 175.—COUES, *Am. Nat.* i, 1867, 395. (Habita).—GRAY, F. Z. S. 1868, 301.—ALLEN, *Proc. Bost. Soc.* xvii, 1874, 42. (Yellowstone).

*Dipodomys montanus*, BAIRD, *Proc. Acad. Nat. Sci. Phila.* vii, 1855, 334.

*Dipodomys phillipsi ordii*, COUES, *Proc. Phila. Acad.* 1875, 326.—COUES & YARROW, *Zool. Expl. W.* 100 Merid. 1875, 109.

**HABITAT.**—Rocky Mountain region at large, and somewhat eastward, from the region of the Yellowstone into Mexico. Limit of southern extension not precisely determined. Specimens examined from the Yellowstone, Powder, Niobrara, Platte, and Arkansas Rivers; from various localities in Texas, and nearly throughout New Mexico and Arizona; from Sonora, Durango, and Coahuila, Mexico.

**CHARS.**—Larger: rather over than under 4 inches in length of head and body, with (comparatively) stout shape, small ears, short limbs, and short tail. Tail vertebrae 1 inch (more or less) longer than the head and body, bearing a proportion of about (rather less than more) 1.25 to 1.00. Coloration light: upper parts nearly uniform tawny-brown, of the shade peculiar to the genus, darkened a little with mouse-brown on a dorsal area.

\* Beiträge zur Kenntnis der Säugethiere Amerikas. < Abhandl. d. math. phys. Classe d. k. bayer. Akad. München, v, 1847-49, 319, pl. vii (forming vol. xii of the series of Denkschriften). [Quoted from Baird.]



This form of the genus appears to have been first noted by Dr. Woodhouse in 1853. His specimens were from El Paso. The known limits of its distribution were enlarged in 1857 to include the region of the Platte; while specimens still more recently examined show that it extends northward to the Yellowstone at least, further east in Dakota, Nebraska, and Kansas than was formerly supposed, and even reaches to Arkansas, where specimens were lately procured at Fort Cobb.

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NOTE.—The special papers in which the *Sacomys* have been treated will be found quoted *passim* in this article; these citations constituting that portion of the bibliography of the family which I have compiled.

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MONOGRAPHS  
OF  
NORTH AMERICAN RODENTIA.

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No. IX.—HAPLODONTIDÆ.

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By ELLIOTT COUES.

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## LETTER OF TRANSMITTAL.

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OFFICE OF UNITED STATES GEOLOGICAL AND  
GEOGRAPHICAL SURVEY OF THE TERRITORIES,  
*Washington, D. C., December 1, 1876.*

SIR: I have the honor to transmit herewith, for publication as one of the series of "Monographs of North American Rodentia", a memoir on the family *Fapodontidae*.

To the single species which constitutes this family, unusual interest attaches, in the facts that its structure has remained very imperfectly known up to the present time, and that its systematic position consequently has been a matter of dispute. The anatomy of the species is herewith presented at considerable length, from original dissections; and a notice of its history and habits follows the description of its structure.

Like my other memoirs of this series, the present is based upon the material contained in the National Museum, for the opportunity of examining which I am indebted to the liberal policy of the Smithsonian Institution.

I am, Sir, &c.,

ELLIOTT COUES,  
*Assistant Surgeon United States Army,  
Secretary and Naturalist of the Survey.*

Prof. F. V. HAYDEN,  
*United States Geologist-in-charge.*



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## FAMILY HAPLODONTIDÆ.

= Genus *Aplodontia*, RICHARDSON and AUTHORS (see beyond).

< *Sciuridae* or *Castoridae*, of some AUTHORS.

< *Castorinae*, BAIRD, Mamm. N. Am. 1857, 350 (united with *Castor* in a subfamily *Castorinae* of *Sciuridae*).

= *Haplodontidae*, LILLJEDONG, Syst. Öfv. Gæng. Däggdj. 1886, 41 (as family of the Hystriomorph series).

= *Haplodontidae*, GILL, Attag. Fam. Mamm. 1873, 29 (as family of a special series, *Haplodontioides*).

= *Haplodontidae*, ALSTON, Proc. Zool. Soc. Lond. 1876, 78 (as family of the Sciuromorph series).

CHARS.—*Teeth*: I.  $\frac{1}{1}$ — $\frac{1}{1}$ ; C.  $\frac{0-0}{0-0}$ ; Pm.  $\frac{2-2}{1-1}$ ; M.  $\frac{3-3}{3-3} = \frac{6-6}{3-3} = \frac{12}{12} = 22$ ; all rootless, prismatic, simple, of unique pattern of the molar crowns. *Vertebrae*: C. 7; D. 13; L. 6; S. 5; Cd. 11 = 42. *Seventh cervical* semicostiferous, without vertebral arterial canal. *Clavicles* perfect. *Scapula* triangular, with prominent spine and well-developed acromion and coracoid. *Tibia* and *fibula* not ankylosed, though closely apposed below. *Ulna* with long olecranon; *radius* perfect, admitting of rotatory movements. *Carpus* and *tarsus* each with *nine* bones, including an os intermedium. *Humerus* with well-developed greater and lesser tuberosities, deltoid ridge, and tubercle; the inner condyle perforate. *Femur* with prominent greater and lesser trochanters, gluteal ridge and tubercle. A large osseous *patella*. *Pelvis* straight and narrow; *ilia* prismatic, projecting beyond the sacrum. *Thorax* capacious, contracted anteriorly, with 13 ribs, 7 sternal, the first borne partly upon the last cervical vertebra. *Skull* with no trace of postorbital processes (so conspicuous in *Sciuridae*), massive, greatly depressed, very broad behind; *zygomata* widely separated behind, chiefly constituted by the *malars*. *Anteorbital foramen* low in position, small, oval, oblique, transmitting a fascicle of the masseter. *Lachrymal* large, scale-like. *Nasals* broad, not protrusive. *Mandible* massive, the descending ramus broadly laminar, twisted into the horizontal plane; *coronoid* high, falcate. A large *hyoid*, connected with the skull by long osseous cornua. *Right lung* quadrilobate; *left lung* bilobate. *Salivary glands* enormous (as in *Castoridae*). *Stomach* with the cardiac portion produced into a horn-like process. *Liver* quadripartite, the left lobe with a long process, the Spigelian lobule bifid.



*Intestines* many (about eleven) times as long as the body. *Cacum* very large (as long as the body). Outlets of *genito-urinary* and *digestive* organs distinct from each other (compare *Castoridae*). *Testes* abdominal. *Os penis* very large, cleft at the end. *Urethral glands* few and simple (no other perineal glands?)

For other characters, derived from the external structure, and properly to be considered as rather pertaining to the genus than to the family, see under next head.

As may be gathered from the foregoing epitome of the more salient anatomical characters, the present is a remarkably peculiar group, entitled to full family rank, if not to still higher appreciation. Like the equally peculiar *Castoridae*, it has, as one author has remarked, long proved a stumbling-block in the way of a systematic arrangement of the Rodents; but for no other reason, as it seems to me, than because authors long regarded the type of structure as only significant of a genus, a place for which was to be found perforce among the then established families, instead of recognizing its claims to higher valuation. It would be idle to recount the various forced associations to which the family considered as a genus has been subjected.\* The general tendency has been, however, of late years at any rate, to associate *Haplodon* more or less intimately with *Castor*, and to refer both genera to the Sciurine series, if not to the *Sciuridae* itself. Thus, in 1858, Professor Baird made *Castor* and "*Aplodontia*" together a subfamily *Castorinae* of the family *Sciuridae*,† inquiring pertinently whether the two were not typical of as many distinct subfamilies, themselves forming a group of full family rank. Professor Brandt had already, in 1855, placed the genus next to *Castor*. In 1864, Herr W. Peters discussed the genus, comparing the skull with that of *Arctomys*, and noting the strong resemblance observable in many respects; he is considered by Mr. Alston‡ to have "definitely established" the Sciurine affinities of the genus. In 1866, Professor Lilljeborg (*l. s. c.*) first, as far as I can ascertain, cleared the way for the required improvement in classification, by raising the genus to the rank of a family, which he called *Haploodontidae*, and placed next after *Sciuridae*; although, as Mr. Alston (*l. i. c.*) observes, he

\* For example, in 1840, Schinus threw "*Aplodontia*" into his VII "family" of Gilves, "*Cantularia*" which consisted of an odd jumble of *Haplodon*, "*Acomys*" (= *Geomys*), *Thomomys*, *Siphonops*, *Ctenomys*, *Spalax*, and various other burrowing Rodents; as such, being beneath serious criticism.

† Baird's family *Sciuridae*, however, included the Murine family *Myosidae*, treated as a subfamily *Myosinae*.

‡ P. Z. S. 1876, 66.

"strangely relegated it" to the Hystricine series of Rodents. Dr. T. Gill (*l. s. c.*) followed Lilljeborg in 1872 in recognizing a family *Haplodontidæ*, the taxonomic value of which he raised still higher by separating it from other *Gliræ* as the type and sole member of a "superfamily" *Haplodontoidæ*, coming next after *Castorida*; also made the basis of a superfamily *Castoroidea*. Lastly, in 1878, Mr. Alston (*l. s. c.*) endorsed a family *Haplodontidæ*, which he placed next to *Castorida* among *Sciuromorpha*.

To waive for the moment the question of absolute rank of the type *Haplodon*, nothing in the way of classifying the Rodents seems to me clearer than that the affinities of *Haplodon* are with *Castor*, and that both these genera appertain to the Sciurine "series", "superfamily", or "line of development"—at any rate, neither to the Murine nor to the Hystricine series; the next nearest relationship of *Haplodon* being with *Arctomys*, and so with the *Sciuridæ* itself. The more or less complete agreement of such views with those of the writers mentioned in the foregoing paragraph will be evident without further comment; the better informed authors have, in fact, differed less among themselves respecting the immediate relationships of *Haplodon* and *Castor* than in regard to the location of these forms in the general series of simplicidentate Rodents; *Haplodon*, at any rate, whether considered as genus or as family, having been relegated successively to (1) the Sciurine, (2) the Murine, (3) the Hystricine series, and (4) having formed the type of a different series from any of these; this, too, at the hands of those who are at one respecting its immediate affinities.

This brings up the question of the absolute standing of *Haplodon*. Is it referable to one of the established series of Rodents, or is it to stand alone as the representative of a separate series? Regard for a very strict equivalency of groups might urge the latter appreciation of the value of the peculiarities of *Haplodon*; and, in the sense that the family *Haplodontidæ* differs more from all other families of Rodents than those of the same series usually do from each other, Dr. Gill's special superfamily *Haplodontoidæ* may be justified. But, practically, no exact equivalency of groups is attainable; and, if it were, I should not be satisfied of the necessity of considering *Haplodon* to represent a separate series from the *Sciuromorpha*, in view of the closeness of relationship which I insist is found between *Haplodontidæ*, *Castorida*, and *Sciuridæ*.

In so stating, it becomes necessary to give my appreciation of the limits

of the Sciurine series. Briefly, then, I at present accept a superfamily group *Sciuromorpha* in the sense lately attached to it by Mr. Alston; as including the genus *Sciurus* and its unquestioned allies, as well as *Haplodon*, *Castor*, and *Anomalurus*, with which latter I am acquainted only by descriptions. Since Waterhouse, many years ago, foreshadowed a more refined classification of the Rodents by his four families of *Sciuridae*, *Muridae*, *Hystriidae*, and *Leporidae*, there has been a close general agreement among leading writers that these groups, whatever their absolute rank, represent as many natural major divisions of existing Rodents. The *Leporidae*, by nearly common consent, are now considered as one of two primary divisions of recent *Glirres*, as such comparable in value to all the families of "simplicidentate" Rodents combined. The *Sciuridae*, *Muridae*, and *Hystriidae* of Waterhouse, with whatever modification in details, yet stand as indices of groups of Rodents, of whatever value we may assign, the members of each of which are much more nearly interrelated than any one of them is to any member of either of the other groups. In the paper already several times cited, Mr. Alston seems to me to have defined the three groups, which he calls simply "sections", in a very satisfactory manner; and he certainly has given us an easy means of distinguishing them. "Even if it were not possible to separate the first three of Waterhouse's great families by perfectly constant characters," says Mr. Alston, "they ought, as it appears to me, to be recognized as indicating three distinct lines of development. But by the help of the characters of the leg-bones, pointed out by Professor Lilljeborg, the difficulty is overcome. In the few cases in which the cranial differences fail us in separating the Sciurine rodents from the Murine, and the latter from the Hystricine, the complete anchylosis of the lower part of the tibia and fibula in the second group comes to our aid. . . . The first and third groups, which agree with one another in this point [distinction of fibula], are at once separated from each other by the form of the mandible, as well as by the whole type of cranial structure. . . . The first section, *Sciuromorpha*, has for constant characters the combination of a peculiar form of mandible with the persistence of the fibula as a distinct bone throughout life. The former character at once separates it from the *Hystriomorpha*, the latter from the *Myomorpha*." This is the sense, then, in which I am to be understood to accept the *Sciuromorpha*, in my present reference of the *Haplodontidae* to that series as one of its component families,

coming between *Castoridae* and *Sciuridae*, with close relationship on the one hand with *Castor*, and on the other with *Arctomys*.

My views of the position in the Rodent series, and relative rank in the scale, of the Haplodont type rest upon an examination of the whole structure of the animal. I do not find that any one has hitherto examined—at any rate, given an account of—the viscera, or even the skeleton, excepting the skull and leg-bones; our knowledge having thus far rested upon these portions of the bony frame-work, the teeth, and the external characters. I am, consequently, enabled to add many new particulars to substantiate the position here taken. Detailed descriptions are offered beyond under head of the species; here I shall simply advert to some of the leading points involved.

The skull of *Haplodontidæ* is strongly and unmistakably Sciuromorphic, not only in its general structure, but in many ultimate details. In fact, it resembles in superficial aspect the skull of certain typical Sciurines more closely than some of these resemble each other. For example, no one who compares the skull of *Haplodon* with that of *Arctomys* can fail to be struck, as Dr. Peters was, with their close general resemblance. In comparison with *Sciurus*, or even with such a Marmot-like form as *Cynomys*, the skull of *Arctomys* is seen to be much more massive, much more depressed, broader behind, and with a straightness and mutual perpendicularity of various planes, all of which features would require little exaggeration to match those of *Haplodon*. Even the shape of the angle of the mandible, peculiar to *Haplodon*, is really approached in *Arctomys*, where further twisting of the already oblique plate of the descending ramus would bring it into the nearly horizontal plane which it occupies in *Haplodon*. The most prominent difference is the total absence of postorbital processes in *Haplodon*, and their full development in *Arctomys* as in other *Sciuridae*. It may be fairly questioned, however, whether the presence of these processes is more than a character of the family *Sciuridae* itself; for they are lacking\* in the three other families referable to *Sciuromorpha*. The preponderance of recent genera and species of *Sciuridae* may have unconsciously led us to attach too great importance to this feature. Obviously, the fact that the family *Sciuridae* at present contains many genera, while the other three Sciuromorphic families have but one genus apiece, is no argument for the making of postorbital processes a requisite for any series of Sciurines of higher value than a family. The argument is the other way, in

\* Mr. Alston calls them "obsolete" in *Asomaluridae*.

view of the fact that out of four Sciurine families only one, *Sciuridae*, possesses these processes.

I might extend this comparison of *Haplodon* with *Sciuromorpha* into many other points of structure, and enlarge upon various Marmot-like characters; but the indications afforded by the skull seem to me so unmistakable, that such course becomes unnecessary. I will only refer, further, to the general mode of life, in which, as is well known, the Sewellel agrees with the Marmot-squirrel section of *Sciuridae*. It lives in communities in subterranean burrows, exactly like the species of *Cynomys* and of *Spermophilus*. Various resemblances, in fact, have caused some authors to refer the species to the genus *Arctomys*, and Rafinesque made it congeneric with *Cynomys*.

The condition of the molar teeth, whether rootless and prismatic, or rooted and tubercular, usually gives good indications among Rodents. In this important respect, *Haplodon* agrees with *Castor*; and although the dental formulæ are not identical, yet the only discrepancy is in the presence of a very small upper anterior premolar in *Haplodon*,—a tooth functionally insignificant, and, in fact, appearing as if it were far on the way toward suppression. In comparing *Haplodon* with *Castor*, we indeed find many discrepancies, even to the presence in the latter of an additional rib and dorsal vertebra, common outlet of genito-urinary and digestive systems, peculiarly developed perineal glands, &c; but we should not lose sight of the fact that the secondary or adaptive modifications of *Castor*, in fitting it for an aquatic life, are impressed with unusual strength, and are consequently liable to obscure those points of structure more valuable in indicating affinities. Even in some of its soft parts, however, *Haplodon* shows special relationships with *Castor*, such as the presence of a glandular collar formed by the enormous salivary organs.

I am inclined to consider the Haplodont type as probably the oldest among existing Sciuromorphs, and as nearer the ancestral type from which also diverged *Castor*, *Anomalurus*, and *Sciurus* with its numerous allies,—the latter being the most specialized and diversified forms which have been evolved from a primitive stock, and having become its largely predominant representatives in the present epoch. This view is strengthened by the remarkably restricted geographical distribution of the single known species, and the numerical proportion of its individuals,—altogether inconsiderable in comparison with the abundance of the typical *Sciuridae*. The simple molars of *Haplodon*, as the very name indicates, may be regarded as further evi-

dence of an "early" or "generalized" type, in comparison with the highly complicated teeth of many recent Rodents; no simpler tooth than the anterior upper premolar—a mere cylinder—can well be, while the other molars are simply cylinders pinched into a fold on one side; being thus remotely removed from such remarkably intricate and "specialized" aggregations of numerous prisms as are shown by many recent Rodents.

### GENUS HAPLODON, (Rich.).

× *Anisonys*, sp., RAVINESQUE, Amer. Month. Mag. 5, 1817, 45 (genus based on a species of *Cynomys*, with a species of *Hapiodon* included).

= *Aplodontia*, RICHARDSON,\* Zool. Journ. iv, 1829, 334 (original characterization).—RICH., Fa. Bor.-Am. i, 1829, 210 (substantially the same).—AUDUBON & BACHMAN, Quad. N. Am. iii, 1853, 98 (copied from Richardson).—BAIRD, Mamm. N. Amer. 1857, 350 (elaborately recharacterized).

= *Aplodontia*, FISCHER, Syn. Mamm. 1829, 598 ("396" by err. of pagination).

= *Haplodon*, WAGLER, Syst. Amphib. 1831, 23.—WAGNER, "Suppl. Schreb. iii, 1843, 396".—PETERS, Monatsb. Akad. Berlin, 1864, 177 (discussion of affinities).—ALSTON, Proc. Zool. Soc. 1876, 78 (classificatory).

= *Aplodontia*, RICHARDSON, Sixth Ann. F.-p. Brit. Assoc. Adv. Sci. for 1836, 1837, 150, 157.

= *Haplodon*, or *Haplodon*, BRANDT, "Beit. Kennt. Säug. Russl. 1855, 150".

= *Haplodon*, LILLJEBORG, Syst. Öfvers. Gnag. Diggdj. 1868, 49.

(Other forms of the word are doubtless to be found.)

CHARS.—Form stout, heavy, low; body cylindrical; limbs short, of proportionate lengths before and behind; no appreciable neck; head broad, flat, somewhat triangular, with blunt muzzle, hairy, except the margin of the nostrils and cleft of the upper lip. Tail very short, terete, hirsute. Whiskers very long, bristly. No cheek-pouches. Eyes diminutive. Ears of moderate size, rounded above, lobate below, with antitragal fold. Fore and hind feet pentadactyle, hairy on top; palms and soles naked; former 5-tuberculate, latter 6-tuberculate; digits of hind feet not webbed; fore claws much longer and stouter than the hinder, fitted for digging. Pelage of two kinds,—long bristly hairs and woolly under fur. Progression apparently plantigrade. Habits terrestrial, fossorial, gregarious. Regimen exclusively vegetarian. Voice shrill.

To the structural characters already given, being those upon which a family *Hapodontidae* is established, may be added the foregoing, derived from

\* Special paper: On *Aplodontia*, a new genus of the order Rodentia, constituted for the reception of the Sewelle, a burrowing animal which inhabits the north-western coast of America. < Op. tom. cit. pp. 333-337.

On a second described species of *Haplodon*, cf. Peters, Ueber neue Arten der Säugthiergattungen Geomys, Haplodon und Dasypus. < Monatsb. Akad. Wiss. Berlin, 1864, pp. 177-180.

A third special paper is: The Hunting Fields of the Pacific Coast, Oregon. Capturing the Shrew. By J. M. Murphy. < "Rod and Gun" (newspaper) of May 30, 1876. [Popular.]

consideration of external form, upon which a genus *Haplodon* may be properly based. In the account of the species which is to follow, much of the structure of the animal is given in detail, without reference to the systematic significance of any of the features described.

The genus "*Aplodontia*" was established by Richardson in 1829, and, with varying orthography, has since been universally employed. Nor is it necessary to supersede it by *Anisonyx* of Rafinesque, 1817. This generic term, besides arising in a misunderstanding, was based upon the "Burrowing Squirrel" of Lewis and Clarke, and is equivalent to *Cynomys*, of same author and date. It therefore becomes a synonym of *Cynomys*, as the type species, "*Anisonyx brachiura*", also is of *Cynomys columbianus* (Ord). Rafinesque, however, added to his genus *Anisonyx* a second species, *A. rufus*, based exclusively upon the Sewellel of Lewis and Clarke, which causes *Anisonyx* to be partly synonymous with the subsequent "*Aplodontia*" of Richardson.

The construction of the generic word has apparently given trouble, though there need have been none, had the rules for the formation of compounds from the Greek been duly considered. While some latitude is allowable in such cases, unwarrantable liberties have been taken with this word. The etymology is ἀπλός (contr. ἀπλοῦς), *simplex*, simple, and ὀδούς, *dens*, tooth. The original form, *Aplodontia*, is clearly wrong in ignoring the aspiration of the initial Alpha, and is further modified arbitrarily by the suffixed syllables. As to the mode of joining the two words, in which three Omicrons come together, it may be observed: that the latter o in ἀπλός would, of course, suffer elision before the initial vowel of ὀδούς; and then the former o, still coming before a vowel, would either be separated by a diæresis over the second o, or else be contracted with it into ou; so that the word might be written, with propriety, *Haploödon* or *Haploudon*, the latter perhaps being preferable, especially in view of the contracted form ἀπλοῦς, in which the original is also found. But euphony has rightly so much to do with these formations that the former o in ἀπλός, as well as the latter, may be struck out before the ὀ of ὀδούς (just as the latter o may be omitted before a consonant, contrary to general rule, as in ἀπλότης, compounded of ἀπλός and the abstract termination της, or in ἀπλοσψήμων), and the word be properly written *Haplodon*, the form I have adopted. In any event, *Apludontia* and *Apluodontia* are inadmissible, and *Hapludon* is objectionable from excessive contraction. In strictness,



we should rather write *Haploōdus*, *Haplodus*, or *Haploudus*; but the form of *ῥόδους*, in which the stem *ῥόδοντ-* is preserved, is so firmly established by precedent and custom, that it would be finical to insist upon the purer orthography.

## HAPLODON RUFUS, (Raf.) Coues

## The Sewellel.

- Sewellel*,<sup>\*</sup> LEWIS & CLARKE, Trav. 1st Am. ed. in 2 vols. 8vo, ii, 1814, 176 (1st English ed. in 1 vol. 4to, 1814, 470; 2d English ed. in 3 vols. 8vo, 1815, iii, 39). (Original description.)—COUES, Bull. U. S. Geol. & Geogr. Surv. Terr. 2d ser. no. 6, 1876, 437.
- Anisonyx rufa*, RAFINESQUE, Amer. Month. Mag. ii, 1817, 45 (actually based entirely upon the Sewellel of Lewis and Clarke).—DESM., Mamm. ii, 1822, 330.—LESS. Man. 1827, 240, no. 647.
- Arctomys rufa*, HARLAN, Fn. Amer. 1836, 308.—LS. GEORGE, "Diet. Classique, x, p. 186".—GRIFFITH, An. Kingd. v, 1827, 245, no. 636 (compiled).
- Aplodontia leporina*, RICHARDSON, Zool. Journ. iv, 1829, 335, no. 15.—RICHARDSON, Fn. Bor.-Amer. i, 1829, 211, pl. xviii C, figs. 7-14 (skull).—SCHINZ, Syn. Mamm. ii, 1840, 138 (description, &c.).—FRALE, Mam. & Birds U. S. Expl. Exped. 1848, 56, 'pl. xv', fig. on p. 57 (skull).—AUDUBON & BACHMAN, Quad. N. Amer. iii, 1853, 99, pl. cxxiii (animal). (Description and account of habits, mostly from Lewis and Clarke, and from Richardson.)—NEWBERRY, Pac. R. R. Rep. vi, 1867, Zoölogy, 68 (habits, &c.).—BAIRD, Mamm. N. Amer. 1857, 363, pl. xx, figs. 4 a-d (details of external form), and pl. xlix, figs. 2 a-c (skull and teeth).—COOPER, Pacific R. R. Rep. xii, pt. ii, 1860, 92 (habits).—BUCKLEY, Pac. R. R. Rep. xii, pt. ii, 1860, 100 (habits, &c.).—BUCKLEY & GIBBS, Pac. R. R. Rep. xii, pt. ii, 1860, 124 (description, habits, &c.).
- Aplodontia leporina*, FISCHER, Syn. Mamm. 1829, 598 ("398" by error of pagination).
- Aplodontia leporina*, RICH., Sixth Ann. Rep. Brit. Assoc. for 1836, 1837, 157.
- Haplodon leporinum*, WAGNER, "Zool. Journ. 1839, —".
- Haplodon leporinum*, WAGNER, "Syst. Amphib. 1830, —".—WAGNER, "Suppl. Schreb. iii, 1843, 396".—GIEBEL, Mag. 1855, 527.
- (†) *Haplodon leporinus* var. *californicus*, PETERS, Monatsb. Akad. Berlin, 17. März 1864, 179 ("Gebirgen Californiens").

CHARS.—About as large as a Muskrat. Length, a foot (more or less); head, 3.00 inches; tail-vertebræ, 1.00; tail with hairs about half as much again; fore foot, 1.75; hind foot, 2.10; longest fore claw, 0.50–0.60. Color brownish, mixed with more or less black, lighter and more grayish below; basal portions of the pelage mostly plumbeous. Whiskers, claws, and upper surface of foot colorless, or nearly so; incisors yellow.

HABITAT.—Washington and Oregon Territories from the Rocky Mountains to the Pacific; upper portions of California, and probably also southern portions of British Columbia.

## A.—DESCRIPTION OF EXTERNAL CHARACTERS.

The Sewellel approaches the Muskrat in size; and in some superficial aspects is not very dissimilar to that well known animal. The general form is stout and clumsy; the body is of large calibre in comparison with its length; the trunk is nearly cylindrical, broadly rounded off behind, in front

<sup>\*</sup> See beyond in this memoir for other forms of this Indian word, and its meaning.



without appreciable constriction of the neck, upon which the shoulders seem to encroach; the head is especially broad, the width across the occiput being, if anything, greater than the breadth across the shoulders; the limbs are short, of approximately equal lengths, massive above the wrist and ankle; the tail is very short; the muzzle is thick and blunt; the whiskers are long and stiff; the ears are of moderate size; the pelage is soft. The whole organization, viewed externally, indicates terrestrial and highly fossorial habits. In moving, the animal carries the body low, almost sweeping the ground; at rest, the back is arched.

The head is broad and massive, much compressed in the horizontal plane (being wider than deep), and especially noticeable for the flat expanse of its upper surface, which is continuous with that of the shoulders without depression of the nape, and with scarcely any constriction of the sides of the neck behind the ears. Viewed from above, the sides of the head taper gradually, in nearly straight lines, from the broadest point (at the ears) to the snout, which is extremely obtuse. The profile of the forehead is likewise nearly straight. The chin is retreating; its under surface is nearly flat; the end is broadly convex, like the rest of the obtuse muzzle. The opening of the mouth appears contracted from the thickness of the swollen fleshy lips. The upper incisors are probably always exposed. The peculiar shape of the head as a whole is correlated with the remarkable preponderance of planes and right lines which the skull shows.

The thick lips are entirely hairy, the upper lip especially being clothed with short, stiffish, antrorse, adpressed hairs for some distance within the apparent buccal orifice, and there being a special brush of similar hairs directed inward, near the commissure of the lips. There is a narrow naked muffle, cleft with a well-marked vertical line of impression; a naked pad projects from this to the interspace between the upper incisors; a narrow margin around each nostril is also naked; otherwise the snout is entirely hairy. The whiskers are numerous, very long, and extremely stiff—more like hog's bristles than the whiskers of most Rodents. The longest ones, when laid backward, reach entirely beyond the shoulders. These bristles are mostly colorless; some of the shorter upper ones, however, are brownish. Besides the labial set proper, there are other long bristles, also mostly colorless, in tufts over the eyes, and scattered about the ears; both lips are thickly fringed with similarly colorless, short, but still stiff, bristly hairs, in addition

to the pelage proper of the parts; while there is a scattering patch of the same on the chin. The countenance of the animal literally "bristles"; and, as we shall see, similar long colorless bristles occur on other parts of the body.

The eyes are situated in a line between the extremity of the snout and the middle of the ear, about half-way, but rather nearer the ear. They are remarkably small, the diameter between the canthi being only about a quarter of an inch, and appear somewhat sunken and inexpressive, from the tumidity of the lids. The ear, it has been said, "strongly resembles the human one in form", and may be conceded to be not strongly dissimilar in some respects, the auricle being rounded above, with a folded-over anterior edge, having a thickened projection near the base in front to represent the human antitragus, and a fleshy dependent part opposite, in the place of the human lobe. The ear is situated upon the most prominent postero-superior aspect of the head, and rises about as high as the fur of the surrounding parts; an anterior fourth of the auricle is folded over; when pressed out flat, the contour of the auricle is nearly semicircular. The antitragal prominence continues far into the cavity, forming a fold which bounds the meatus above; the lower boundary of the external meatus is the large thick fleshy lobe already alluded to; it seems to be mobile, and is probably capable of closing the orifice by its apposition with the antitragal ridge. The ear is clothed uniformly with short soft hairs; there are some longer ones on the concavity which overtop the auricle, thus forming a decided fringe, and other long ones in tufts on the borders of the ear near its base. These longer hairs are colored; the very short ones on the back of the ear, and others on the fleshy lobe, are colorless.

The fore limbs are close to the head; the outline from the head down the front leg is a continuous curve, and the point of the shoulder seems scarcely half an inch from the back lower corner of the skull. The massiveness and muscularity of the upper portions of the limb, no less than the structure of the hand, indicate great fossorial powers, reminding one of the condition of the parts in *Geomys*.\* From the stout shoulder and prominent elbow, the fore limb becomes conoidal, tapering rapidly to the contracted wrist, where the ordinary long pelage of the body ceases. The back of the

\* If *Haplodon* possessed external pouches, its superficial appearance—the stout, squat, lumpy figure, the large head, apparent absence of neck, short legs, highly fossorial fore feet, with enormous fore claws and great tubercles at the wrist—would more strongly resemble *Geomys* than any other animals of this country.

hand is rather thinly but uniformly clothed to the ends of the fingers with short adpressed hairs like those on the concavity of the ear. The palms and under surfaces of the fingers are perfectly naked. The hand is large, measuring in length from the wrist to end of the claws but little less than the distance from wrist to elbow. There are five perfect digits. Of these, the 1st, or thumb, is very short, its tip falling far short of the base of the 2d digit; its axis is very oblique to the line of the other digits, from which it stands apart quite as much as the human thumb does from the fingers; nor can it be readily pressed into line with the other digits, on account of its intimate connection with the inner one of two great palmar tuberosities, to be presently noticed. The thumb bears a small, stumpy, obtuse claw, compressed nevertheless, and a true claw, not a flat nail, as is so frequently witnessed in Rodents when the thumb is very short or rudimentary. The thumb in this case, though relatively very short, is functionally developed beyond doubt, and its curious opposition to the other digits almost indicates true prehensile or grasping powers of the hand. The remaining digits are long and well formed; the 3d is longest; the 4th and 2d successively shorten in nearly constant ratio; the 5th is relatively shorter, the tip of its claw falling but little in advance of the base of the 4th claw. The claws are all nearly or quite as long as their respective digits, reaching about the development witnessed in *Geomys*. They are little curved, and much compressed; for most of their length underneath their sides come together in a single ridge, leaving but a slight scooped-out portion toward the ends. The tuberculation of the naked palms is conspicuous. Near the wrist, opposite the thumb, are two immense prominences, side by side (inner and outer); the ulnar, or outer one, about in the site of the human pisiform bone, is smaller, and more compressed than the radial tubercle, at the base of the thumb, which attains the size of a pea, and is irregularly nodular, with a tendency to lateral compression and the formation of a decided lengthwise keel. These wrist-tubercles have almost the development seen in *Geomys*. At the bases of the digits are three large, smooth, flattened tubercles, one common to the 3d and 4th digits, the others respectively proper to the 2d and 5th. The ends of the digits are somewhat callous. For the rest, the palm is smooth, with an irregular network of lines of impression, and the under surfaces of the digits are strongly annulate with similar transverse lines.

The hind limbs correspond in length with the fore. The massive thigh

is entirely enclosed in the common integument of the body, which even descends a little below the knee. The bulging, compressed crus tapers rapidly to the ankle, where the ordinary pelage of the body is arrested, the instep and tops of the toes being clothed with very short, adpressed, colorless hairs, and hence appearing almost naked, as, indeed, they have sometimes been described. But the clothing is uniform and complete, and nearly as heavy as that on the back of the hands. The foot is rather longer than the hand, even including the claws, which are so highly developed on the fore limb. The axis of the foot appears to be nearly at right angles with that of the leg in ordinary postures of the animal; the heel is prominent, and the whole sole is evidently applied to the ground in walking. Such plantigrade character of the hind feet is indicated by the strong flattening of the sole to the very heel, and its complete nakedness. The sole is perfectly smooth, with a moderate number of irregular lines of impression, more numerous anteriorly than toward the heel. There are six prominent tubercles on the sole; four at the bases of the digits, and two, side by side, about half-way to the heel. Of the anterior tubercles, one is common to the 3d and 4th digits, and three others are respectively proper to the 1st, 2d, and 5th digits. Of the posterior pair of tubercles, a larger one, conical and very prominent, is situated on the inner side of the sole; the other, much less conspicuous, is also further removed from the edge of the foot. There are five perfect digits, with nearly parallel axes, though the lateral ones, and especially the inner one, stand a little away from the line of the other three. These last are much the longest, and of approximately equal lengths. The end of the claw of the 5th only attains the base of the 4th claw; that of the 1st does not quite reach the base of the 2d. The claws of all the digits are much alike, and peculiar in no respect.

The tail is a mere stump, shorter than the foot; it is cylindrical, thickly clothed with pelage like that of the body, and the terminal pencil of hairs equals in length that portion of the vertebra which projects beyond the buttocks. Short as this member is, it is not "concealed" in any of the specimens before me. It is much more conspicuous than that of *Lagomys princeps*.

The general pelage has been likened to that of a rabbit when out of season; it seems, however, to be coarser, owing to the number of long, stiff, almost bristly hairs which are mixed with the dense, soft, woolly under fur. These staring hairs are specially noticeable on the limbs and under parts gen-

erally. Some of them are colorless, like the hairs upon the face; and, indeed, there is upon the back of the fore arm a special tuft of long colorless bristles, quite like the shorter whiskers. The long scattered hairs of the upper parts are black, giving a darker tone to the reddish-brown or chestnut of these parts; on the under parts, the cast is more grayish. The basal portion of the pelage is dark plumbeous above, paler or grayish below. I have not sufficient material to indicate the range of individual color-variation. Some specimens are said to be quite blackish. None of those examined show a pure white throat-patch, spoken of by some writers; but it is indicated in some cases by a few white hairs. The hands, feet, and ears appear whitish, at least in contrast with the general dark body colors; and the short pelage of the lips, anus, and præputial sheath is usually more or less whitened. The claws are nearly colorless; the incisors are yellow.

The anus is situate a considerable distance from the root of the tail. In the male, owing to the size of the os penis, the sheath of the penis forms a large conical projection immediately in front of the anus, and is directed more or less backward; it is hairy, with a long, slender, terminal pencil. The penis may be readily protruded in alcoholic specimens. There is no appearance of a glans. The bone extends to the end of the member; it is elsewhere described. I have seen no female specimens. There are said by Richardson to be six mammæ, the position of which is indicated by brown circular marks, the anterior pair being situated between the fore legs.

#### B.—DESCRIPTION OF THE TEETH.

The incisors offer nothing specially noteworthy. They are very stout for the size of the animal, their anterior faces perfectly smooth, convex in both directions, the sides much bevelled. The under, as usual, protrude farther than the upper, and also incline farther forward as they ascend, the upper being perpendicular. The upper are separated from each other at base by a considerable alveolar interval, but incline toward each other, their points being in contact; the under are more nearly parallel.

The molar series occupies a more posterior position than may be usual in Rodents, the anterior true molar being opposite the middle of the skull. The whole series is about one-fourth as long as the skull. The inner alveolar border is parallel with its fellow; the outer is slightly divergent, owing to increase in size of the teeth from behind forward,—from

the last to the next to the first in the upper jaw, from last to first in the lower. In the upper jaw, the crenate border of the teeth is interior, the straight spurred border exterior; in the lower jaw the reverse. All the molars are rootless and prismatic, as in *Castor*, but not in other Sciuriforms. The dental formula is as usual in *Sciuride* ( $\frac{2-3}{4-4}$ ), but not as in *Castor*. The pattern of the molar crowns is simple, not complicated, as in (all?) other Sciuriforms. In the upper jaw, the anterior premolar is very small, and otherwise different from the rest of the teeth; the other premolar resembles the true molars. In the lower jaw, all the teeth are similar to each other.

The anterior upper premolar is a small simple cylinder, lying very obliquely against the antero-interior corner of the succeeding tooth; an oblique bevelling of its face remedies the obliquity of the shaft, causing the plane of the crown to coincide nearly with that of the other teeth. The other premolar and the three molars proper may be most conveniently described together, afterward noting a slight peculiarity of the former. These teeth are set with strong obliquity outward; they regularly decrease in size from before backward; the shape of the crowns is substantially the same, and presents a pattern probably unique. The horizontal section of each tooth gives a half-elliptical or semicircular figure, with a prominent spur projecting from the straight side. The spur is exterior, the convexity of the half-ellipse interior; so that the molar series, taken together, presents a crenate inner margin, and a straight outer margin with four equidistant projections. The hindmost tooth is semicircular; the increasing width of preceding teeth changes this into the semi-elliptical shape, the anterior tooth being further modified by a slight emargination where the small anterior premolar abuts against it, and further by a slight concavity of the straight outer border on each side of the spur. In some specimens, the regularity of the semicircular or elliptical curves is interfered with; and the back premolar may show, in addition to the emarginations just noted, an emargination of the antero-exterior corner.

The lower series of molars substantially repeats the figures of the upper in the reverse direction, the spurs and straight edges being interior, the convexities exterior. For the rest, the four teeth (1 Pm., 3 M.) differ less in size among themselves than those of the upper series do; the spurs are much less prominent, and the sides of the teeth from which they spring are not so straight; the regularity of the convexity of each tooth suffers from an emar-

gination anterior to the middle of the tooth, which is so strongly pronounced on the anterior one as to produce a decided lobation. For the rest, the under teeth are smaller than the upper, and especially narrower; though the lengths of the two series (excluding the small upper premolar) are the same.

There is no involution of the enamel sheet, nor any other complication of the molar crowns, the island of dentine being surrounded with a wall of enamel with the contour just described.

#### C.—DESCRIPTION OF THE SKELETON.

*Skull.*—The skull of *Haplodon* is remarkable for its flatness or great depression, its average depth (jaw and molars excluded) or dimension perpendicular to the horizontal longitudinal plane being little over one-fourth of its length; for its great width, especially behind the interzygomatic dimension, being between three-fourths and four-fifths of its length; and for the preponderance, as Baird has remarked, "of horizontal planes and straight lines perpendicular to the three coördinate planes. Thus the plane of the occiput is vertical and perpendicular to that of the base of the skull, which itself, as nearly as may be, is horizontal. The general outline of the top of the head is parallel with that of the bottom; the lower edge of the occiput is horizontal, and perpendicular to the horizontal [longitudinal] axis of the skull. The lower edge of the zygoma is nearly rectilinear and parallel with the plane of the palate. In the lower jaw, a vertical plane would be tangent to the condyles and the nearly horizontal posterior edge of the inferior ramus. The planes of the broad coronoid processes are vertical, though inclined to each other." Great as is the zygomatic width relatively to the length of the skull, such width but little surpasses that of the occiput, owing to the great lateral production of the mastoid and auditory bullæ, the latter in some cases extending beyond the mastoids. The skull is further remarkable among *Sciuromorpha* forms for the total lack\* of postorbital processes, the interorbital constriction being much narrower than the rostrum, as in *Arvicola*, *Geomys*, and many other *Myomorpha*. Aside from the absence of these processes, so strongly characteristic of the *Sciuromorph* skull, the skull of *Haplodon* bears a decided general resemblance to that of some *Sciurines*, as *Arctomys*, for example; a resemblance so close, that much the same descriptive terms of contour, &c., would apply to both, and the comparison might be pushed to

\* Shared, however, by *Castor*; in *Anemalurus*, these processes are said to be "obsolete".



include many details, demonstrating the really close relationships of the animal to the *Sciuride*. The interorbital foramen (usually a considerable index of affinity in *Rodentia*), however, is little like that of *Sciuromorpha* generally, while it is not at all like that typical of *Myomorpha*.

Viewed from above, without taking the rostrum into consideration, the general contour of the skull represents a nearly equilateral triangle with rounded-off postero-lateral angles, somewhat convex sides, and sinuous base. There is a very deep notch or emargination just behind the zygomata, sometimes almost converted into a foramen by apposition of the posterior angle of the zygoma against the wall of the produced auditory bulla. Within this triangular contour are a pair of triangular vacuities—the conjoined orbital and temporal fossæ. The posterior extremities of the zygomata are much further apart than a distance equal to their extreme length. The rostral portion of the skull forms rather more than a fourth of the total length; the rostrum is stout, its width being contained only about  $4\frac{1}{2}$  times in the total length; it is approximately cylindrical, with nearly parallel sides converging anteriorly, and tumid nasal portion. The nasal bones are truncate anteriorly, and do not project beyond the plane of the incisive alveoli. From the base of the rostrum on each side, the zygomata suddenly stand off, overshadowing the ante-orbital foramina, which are therefore not visible in this view. Thence the zygomata curve gently outward and backward, then rather suddenly contract, the point at which they are farthest apart being but little in advance of their posterior ends. Behind their ends is the deep emargination, as seen also in *Arctomys*, *Castor*, and other *Sciuromorpha*, but in this case narrower for its depth, appearing almost like a fissure. This separates the zygomatic arch from the prominent angular postero-lateral corner of the skull, formed by the mastoid and auditory bullæ. The posterior outline, on the whole exactly transverse, is sinuous, like the human lip or "Cupid's bow"; for the prominent sharp occipital ridge which defines the occipital plane from that on top the skull, curves backward at first from the corner of the skull and then more strongly forward to the median line, this latter anterior convexity sufficing to throw some of the occipital surface into view from above. The roof of the brain-case is strongly convex and sloping on the sides, though little arched longitudinally; it then spreads more horizontally to form the occipital flanges. This surface is marked lengthwise with a pair of raised lines, indicating the boundaries of the temporal fossæ; at the back border of the orbit, just within



the posterior root of the zygoma, there is a decided depression. Another superficial depression of considerable size is situated between the orbits, just in advance of the point of greatest constriction. This point of greatest constriction lies considerably behind the middle of the skull; the width is there much less than the width of the rostrum. The shape of the opening representing the conjoined orbital and temporal fossæ is that of an inequilateral triangle, with the shortest side antero-internal, the next postero-internal; the longest, formed by the malar, being antero-external. In adults, all the sutures of the top of the skull are obliterated, excepting the naso-maxillary.

The profile view of the skull, the lower jaw being removed, exhibits the remarkable flatness and approximate straightness, horizontality, and parallelism of the upper and under outlines, to which the planes of the occiput and of a tangent to the incisors and ends of nasals are both perpendicular. Along the top of the skull there is a slight bulge in the outline of the parietals, and an equally slight depression over the orbits, whence the profile of the rostrum slopes slightly downward to the end of the nasals. The occiput is perpendicular, and appears nearly straight, though the condyles and paroccipital processes project a little backward, and the end of the occipital crest curves a little forward. The outline of the palate is nearly a continuous straight horizontal line from incisors to ends of pterygoids; behind these, the bullæ auditoriæ project a little downward from the general plane. The anteorbital foramen is not visible from the side, being hidden within the anterior projection of the zygomatic process of the maxillary. Both anterior and posterior roots of the zygoma dip nearly or quite down to the level of the palate; in its continuity, the malar rises with a gentle arch.

Seen from below, the skull presents, of course, substantially the same contour as from above; so we may at once proceed to notice the details. It is only in this one of the three views here described that the anteorbital foramina appear. These are small, simple, oval apertures not prolonged into canals, circumscribed by the two roots of the zygomatic process of the maxillary; they are oblique to all three coördinate planes of the skull, their long axes being directed upward, forward, and outward. Notwithstanding their small size and seemingly inconvenient position, they transmit, as usual, along with the nerve, a little fascicle of the masseter muscle. The incisive foramina, of moderate length, but narrow, reach nearly or quite to the maxillaries, but their sides are entirely bounded by the intermaxillaries. The septum

dividing them seems to be constantly formed by a pair of plates not completely fused; and, just in advance of the main foramina, there is a single median azygos foramen leading into the nasal cavity. This singular opening appears to be constant, and it is of notable size. The palate anterior to the intermolar portion has its sides rapidly sloping upward from the middle line, the actually flat and horizontal portion being extremely narrow, and bounded by a pair of ridges leading from the outer borders of the incisive foramen, with some sulcation between. The intermolar portion of the palate is perfectly flat as well as horizontal, and also rectangular, the lines of the molar series being parallel; this portion equals in length the portion anterior to the molars, and reaches back of the molars for a distance equal to the width of a molar, ending behind with a simple concave edge. There are two pairs of small foramina respectively opposite the last and the penultimate molars, while behind and a little to the inner side of the last molar, on each side, is the larger palatine foramen proper. The portion of the palate anterior to the molars, that between the molars, and the post-palatal remainder of the base of the skull, are all of approximately equal lengths. The pterygoids are, unfortunately, defective in all the specimens before me; they appear, to judge by what is left of them, to have been simple laminae, probably hamulate or falcate, and approximately parallel with each other. The large foramina appear external to their ends, as in other Sciuromorphs. The interpterygoid space is directly continuous with the basioccipital, though with some downward trend. The basioccipital, in consequence of the approximation of the ends of the auditory bullae, rapidly narrows in front, having a general triangular shape, bounded behind by the condyles and paroccipital processes, on the sides by the bullae, in front by the narrow basisphenoid; its surface shows lateral paired depressions separated by a median lengthwise ridge. The auditory bullae are of large size, and horizontal as well as nearly transverse in position, their long axes being nearly coincident; in shape they are somewhat flask-like, being regularly hemispherical at base, then contracting beyond the swollen part, with a tubular prolongation, which extends outward to or sometimes even beyond the extremity of the mastoids, and ends with a simple circular orifice of large calibre, with very thin walls. Their boundaries may be traced in the adult, which is the case with few of the bones of the skull. Behind the bullae appear the paroccipitals and mastoids. The glenoid fossae are of large size, especially long antero-posteriorly, broad and shallow, nearly

plane lengthwise, but much arched in the opposite direction. To the outer side of the glenoid fossæ, the zygomata form a broad flat expansion or horizontal plate, which widely separates the ends of the malars from each other, and largely increases the zygomatic width of the skull, so conspicuous in this species. Nothing of the sort is seen in *Arctomys*, *Sciurus*, etc., where the zygomatic process of the squamosal bends downward from the outer border of the glenoid; while, in *Haplodon*, it forms a broad horizontal shelf for articulation to the malar (\*). At any rate, the broad plate is there, but how much of it is squamosal and how much is malar, the obliteration of the suture prevents me from determining.

The occipital view of the skull is flat, more or less perpendicular, though, especially in younger skulls with decided forward-upward obliquity, two or more times as wide as high, with the general contour of a low isosceles triangle. The straightness of the basal line is chiefly broken by the downward projection of well-developed paroccipital processes; the upper outline curves as already described in speaking of the superior view of the skulls. The general surface is approximately plane as well as perpendicular, though appearing depressed at the sides, owing to the projecting of the flange-like occipital ridge. A considerable portion of the back walls of the bullæ auditoriæ appears upon this plane of the skull, as irregularly quadrilateral plates bounded exteriorly by the mastoids, interiorly by the paroccipitals, and themselves forming a part of the superior border of the occipital plane on each side. The foramen magnum appears mostly in the plane of the occiput, its lower margin merely making a shallow emargination of the base of the skull (more conspicuous in youngish than in old skulls). The perpendicular portion of the orifice is subcircular, but somewhat broader than high; its upper semicircumference is thin-edged, the rest being occupied by the condyles, the articular surfaces of which are remarkably narrow for their length, and closely approximate to each other inferiorly.

As well as can be judged without actual measurement, the capacity of the cranium is decidedly smaller, in comparison with the rest of the skull, than in *Sciurus* proper, or even such a form as *Cynomys*; nevertheless, there does not appear to be much difference in this respect between the cranium of *Haplodon* and that of *Arctomys*. Viewed from the inside, the walls of the brain-cavity show a decided impression for the cerebellum, distinguished by an arched ridge from the cerebral impressions, while the petrosals offer a large subcircular prominence with two conspicuous perforations.

The lower jaw, as Richardson originally observed, is altogether heavier than usual among Rodent's; and it is peculiar in the condition of the descending process, which in this case is a broad, flat plate, so far twisted around that it is horizontal, and its back edge is a straight transverse line. When the two halves of the jaw are separated, each will stand alone upright upon the table, supported by this broad plate, which has twice the width of any other part of the jaw. When the two halves of the jaw are *in situ*, the distance across from tip to tip of these plates equals the distance from each of them to the ends of the incisors; so that the three extreme points of the whole jaw represent the angles of an equilateral triangle; while the inner corners of these plates are only separated by a distance equal to the molar interspace. From the back outer corner of this plate, which is knobbed, and represents the angle of the jaw proper, there sweeps up to the condyle with gentle concavity the edge of a thin plate, which trends strongly obliquely inward and forward as well as upward, so far is the angle of the jaw carried out from the general axis of the bone. The inner end of this plate rounds off to the body of the bone; it projects so far inward that it is separated from its fellow by a distance only equal to the intermolar space. The condylar process is rather low, rising upward vertically in one plane, but with strong backward obliquity (about  $45^{\circ}$  from the plane of the molar crowns). The articular head is nodular, with some posterior prolongation, excepting which latter it is rather broader across than in the longitudinal direction. The coronoid process is very conspicuous, reaching far above the condyle; it is a thin vertical lamina, broadly falciform, with the apex, which is not as high as the convex edge anterior to it, twisted somewhat outward. The anterior border of this plate forms a letter S, very convex above where it curves almost semicircularly over to the apex, less strongly concave below where it sinks into the body of the bone. Similarly, the emargination between the condyle and apex of the coronoid is nearly semicircular. The body of the jaw, on the outer side, opposite the middle of the molar series, shows a strong oblique ridge, indicating the limit of the muscular impression. There is a large foramen at the base of the condylar process on the inner side; the mental foramen is situated on the outer side, midway between the molars and the incisors.

It is to be regretted that the maturity of all the specimens (5 in number) examined prevents recognition of most of the individual bones of the skull, most of the sutures being already obliterated. The part taken by the malar

in the formation of the zygoma, which often affords, especially by its anterior connections with maxillary or lachrymal, or both, valuable indications of affinity among Rodents, remains unknown. I can discern no trace of the sutures. I conjecture, however, from the line of fracture of an accidentally broken specimen, that the malar is anteriorly wedged between two (anterior and posterior) zygomatic processes of the maxillary, and extends nearly or quite up to the lachrymal,—a supposition strengthened by the observed state of the parts in *Cynomys* and *Arctomys*, for example. Similarly, I am of opinion that posteriorly the end of the malar will be found to represent the prominent angle or corner of the zygomatic arch, being splinted underneath a horizontal forward spur of the squamosal. The malar helps to define the brim of the bony orbit by a small projection from its upper edge near the fore end; this is better marked in younger skulls, being obsolete or nearly so in very old ones. With only aged skulls before him, Baird recognized a lachrymal in a tubercle at the fore upper corner of the orbit; in a younger specimen, I see nearly the whole contour of a large lachrymal, lying mostly within the orbit, as a thin scale, thickening only at the edge to form the nodule just mentioned; it has a conspicuous canal. The suture of the palatal plates of the maxillaries and palatines will probably be found opposite the interspace between the last and penultimate molars. Anteriorly, the maxillo-premaxillary and fronto-maxillary sutures are preserved in one specimen; the former encircling the rostrum below and laterally, then trending obliquely backward as it mounts toward the forehead; the latter being a short backward-outward suture opposite the site of the lachrymal. Owing to the narrowness of the nasals posteriorly, the premaxillaries gain the top of the skull in a considerable area; their suture with the frontal is a straight transverse line continuous with the similar naso-frontal suture. Thus the frontal bone ends squarely in a straight line across the forehead, with prominent lateral angles formed by the fronto-maxillary sutures. The nasals, like the premaxillaries, are perfectly distinct all around; their shape has been already noted. For the rest, the auditory bullæ are the only other bones whose whole periphery can be observed in the specimens before me; their remarkable tubular prolongation from a globular base has been sufficiently described above.

*Vertebral column.*—Formula:—C. 7; D. 13; L. 6; S. 5; Cd. 11=42 vertebrae. In life, in a usual position, the backbone from atlas to end of

sacrum presents the usual sinuate S-shape; but the arch of the back and hips is a long, gradual convexity, while the reverse convexity of the fore part of the column, from about the midway dorsal point to the head, is abrupt and strong, the column sinking deeply between the shoulders and then rising almost perpendicularly, as if the animal habitually carried its head thrown up. This great dip of the anterior dorsal and posterior cervical vertebræ, however, is not visible in the external contour of the animal, owing to the bulk of the cervical muscles, which completely fill up the depression between the shoulders and the occiput. The several divisions of the spinal column are well marked by various easily recognized characters.

The *cervical* vertebræ are seven in number, as usual in Mammals; of these, only the intermediate three are quite similar to each other, the first two and the last two having each their peculiar features. The centra of the 3d to 7th vertebræ are equally short, much shorter than the body of the 2d (axis); they increase regularly from 3d to 6th, the 7th being abruptly narrower (about as broad as the 4th); they are all strongly flattened underneath. The spinous processes of the 3d to 6th are simple, and regularly graduated in length, decreasing from before backward; the spine of the 7th is abruptly longer, and more like one of the dorsal spines; all these cervical spines are much slenderer, and all but the 7th are much shorter than the great stout nodular and ridged spinous process of the 2d (axis). The "oblique" articular processes (zygapophyses) of all the cervical vertebræ, excepting the atlas, are substantially alike. The "transverse" (here supposed to be conjoined di- and pleur-apophyses) processes of the axis and four succeeding (2d to 6th) vertebræ are substantially alike, being slender, horizontal, backwardly-projecting, their two roots enclosing the vertebralarterial canal; but the last such process, on the 6th bone, is transverse instead of oblique to the axis of the column, and moreover develops from the under side of its root a special process projecting obliquely downward and backward, no trace of which is seen on any other vertebra. The *atlas* is a simple ring of ordinary characters; slenderest in front, in the position of the centrum of other vertebræ; deeply impressed anteriorly with the articular facets for the occipital condyles, bearing on the other side the flatter but more prominent and more strongly margined facets for the axis; the impression of the odontoid process of the latter upon the middle of the ring is scarcely perceptible. A slight eminence upon the back of the ring stands in place of the spinous processes of the other cervicals.

There are broad flange-like lateral plates or processes, perforate, as usual, for arterial canals. The *axis* develops a stout, erect spine, overtopping that of any other cervical excepting the 7th; it is compressed, prominently and sharply ridged anteriorly; ridged, but less sharply and prominently, behind; and its apex is tuberculate. The centrum is small and much flattened; the odontoid is well marked, and all the front of the body of the bone, including the inferior aspect of the odontoid, presents a continuous articular surface for the atlas. The articular facets for the 3d cervical scarcely represent processes, being simply borne upon the bases of the neural laminae. The delicate "transverse" processes are largely fenestrate with the circular vertebrarterial foramina. The *sixth* cervical is peculiar in the points mentioned above. The *seventh* cervical, as in human anatomy, is a "vertebra prominens", its spine being abruptly longer than that of the preceding bone; it is more than half as long as that of the first dorsal, which, in general appearance, it resembles closely. In other points, this last cervical foreshadows the dorsal series. Its transverse process stands straight out from the axis of the column, like that of the 6th cervical, instead of obliquely backward, as in the rest of the cervical series, and is notably longer than any antecedent one. The centrum is abruptly narrower than the body of the 6th cervical, beginning that compression and cylindricity which marks the dorsal and lumbar series. Furthermore, and chiefly, this last cervical vertebra is "dorsal" in character, in (*a*) possessing no vertebrarterial canal, and (*b*) in bearing on the posterior border of its centrum a demi-facet which takes equal share with that of the 1st dorsal in the articulation of the 1st rib.

Of the thirteen *dorsals*, the 1st is mainly discriminated from the last cervical by the presence on the apex of the transverse process of a cupped facet for the articulation of the tubercle of the 1st rib; for we have just seen how closely the last cervical simulates characters of a dorsal, even to taking its share in bearing a rib. Its spine is, however, abruptly still longer; its transverse process is altogether stouter (besides bearing a facet); and its body is narrower, longer, and more nearly cylindrical. The last (13th) dorsal is distinguished from the 1st lumbar by presence of the facet for the last rib, and by total lack of a small anterior prolongation or point of the "transverse" process, which is readily recognizable upon the anterior lumbar, and becomes very conspicuous on succeeding bones of that series. The centra of the dorsals grow longer, narrower, and more protuberant inferiorly from the 1st to



about the middle of the series, when, with still increasing length, they also widen again and gradually assume the slight hourglass-like contraction, which is more conspicuous in the lumbar series. The centra all bear costiferous demi-facets, one at each end, to the 9th, which has only one such demi-facet on the fore end, and none on the other (as well as can be determined in the dried state of the bones examined); the last four (10th to 13th) have full facets upon their fore ends. The spinous processes of the anterior half-dozen dorsals are long, slender, compressed, tapering to a knobbed point, excepting the 1st one, which ends acute, and is abruptly shorter than the next; the 2d to 6th are subequal and longest; all these slender acute spines incline strongly backward, and are packed closely in the concavity of this part of the spinal column. On the 7th vertebra, the character of the spinous processes begins to change; they shorten rapidly in vertical length, and at the same time lengthen horizontally, becoming erect and laminar instead of acuminate, thus merging insensibly into the vertically short, horizontally long, rectangular, plate-like spines of the lumbar region.

The "transverse" processes of the dorso-lumbar vertebræ offer a means of distinguishing between the two series as readily as does the presence of true ribs in one and their absence in the other, whether we pay attention to the homologies of the various elements of which these processes are respectively composed, or simply regard their physical appearance. The dorsal diapophysis proper, by which I mean that portion of the complex "transverse" process which bears a facet for articulation with the tubercle of a rib, is most projecting on the 1st dorsal, and bears a cupped facet; this process regularly diminishes in length, and in the concavity (soon lost) of its facet, to the 10th vertebra, and is entirely wanting, to all appearance, on the 11th to 13th vertebræ, with which the corresponding ribs have no connection except by means of the respective centra. From the upper surfaces of these diapophyses, excepting the 1st one, springs another series of processes, which begins with the 2d dorsal as a simple spur, directed backward, upward, and outward; these rapidly increase in size with successive vertebræ, and with the 6th acquire a new character, becoming expanded and plate-like, and developing an anterior spur as well as retaining the original posterior one. The formation grows more distinct on succeeding vertebræ to the 10th. A decided excavation of circular shape lies on the under side of this plate; the anterior corner overlies the pre-zygapophysis of its own vertebra, and the post-



zygapophysis of any preceding vertebra is thus received in the recess between pre-zygapophysis and its overarching process. I am uncertain of the homology of this process thus surmounting the true diapophysis; but it may be supposed to include both anapophysial and metapophysial elements. Owen says (Anat. Vert. ii, 365) that in Rodentia "the met- and an-apophyses commence by a common tubercle at the fore part of the dorsal series: the anapophysis begins to be distinct at the back part of the series, and the metapophyses to project from above the anterior zygapophysis; both processes are usually well developed in the posterior dorsal and lumbar vertebræ; the diapophysis subsides in the posterior dorsals, and is lengthened in the lumbar by a coalesced riblet (pleurapophysis)". Whatever the theoretical homologies may be in this case, the actual formation is as above given; the structure changes suddenly on the 11th dorsal, from which point backward on the 12th and 13th dorsals, and several succeeding lumbar, both anapophyses and metapophyses may be recognized, separate from each other and distinct from the probably di-pleur-apophyses of the lumbar, which, with the anapophyses, constitute the so-called transverse processes of the lumbar series. On the 11th dorsal, the last vestige of a true diapophysis has disappeared, and with it has gone the above-described plate of bone, which surmounted it in the antecedent dorsals. The side of the bone becomes smooth and erect; a long, pointed anapophysis projects from the hinder border of the bone, lying parallel with the axis of the spinal column. A small, though undoubted metapophysis is given off from the pre-zygapophysis, and such metapophysis and pre-zygapophysis are together locked in between the anapophysis and post-zygapophysis of the antecedent vertebra. Coincidentally with this modification, the planes of the articular faces of the zygapophyses change from nearly horizontal to nearly vertical; rendering the sum of the differences between the 10th and 11th dorsals greater than that subsisting between the last dorsal and the first lumbar, even taking into consideration the different formation of the transverse processes of the lumbar series. Such formation continues through the remainder of the dorsal series.

In the lumbar series, we directly meet, on the 1st lumbar, with a differently constituted "transverse" process. The ribs having ended with the last dorsal, the lumbar develop at once a lateral plate-like "transverse" process, which may be theoretically regarded as a di-pleur-apophysis. This plate increases in size with successive lumbar, projects with each one more and

more obliquely forward, becomes more and more horizontal, and narrows in the fore-and-aft direction coincidently with its increase in lateral projection. Metapophyses, as distinct as those of the posterior dorsals, continue unchanged in appearance part way through the lumbar series. The long acute anapophyses which continue to be given off from the posterior extremities of the "transverse" processes gradually shorten to the 4th lumbar, and are abruptly suppressed on the 5th and 6th, where the "transverse" process appears as a simple, falcate, acute process, projecting horizontally outward with strong forward obliquity. For the rest, the centra of the lumbar are stouter, with more hour-glass constriction than those of the dorsal vertebræ, and the pinching of their sides develops a lengthwise median ridge on the under side. The spinous processes maintain their laminar character throughout; they increase both in length and height to the middle of the series, then decrease in length, but continue to increase in height throughout the series; the anterior ones are perpendicular, as on the last dorsals; there is a gradually increasing backward obliquity to the end of the series. The zygapophyses, both pre- and post-, rise higher and higher with successive lumbar. The last lumbar is entirely embraced between the anteriorly projecting ilia.

The *sacrum* consists of five vertebræ, perfectly ankylosed, yet retaining evident traces of its composition. The two anterior vertebræ are much larger than the other three, which abruptly decrease in size. The former alone join the ilia; their lateral elements are completely fused with each other and with the centra, forming an indistinguishable mass, the outer roughened surface of which constitutes the sacro-iliac synchondrosis. Their spinous processes are, however, distinct from each other, and from those of the smaller succeeding vertebræ; the spines of which latter are, on the other hand, fused into a continuous ridge, as is also the case with their lateral processes. There are five pairs of intervertebral foramina on the face of the sacrum, the anterior pair much the largest, the posterior lying between the last sacral and first caudal; the corresponding apertures upon the convexity of the sacrum are less conspicuous, though still discernible. The osseous ridge denoting the line of fused zygapophyses is plainly traceable; the pre-zygapophysis of the first sacral bears a distinct facet, for movable articulation with the last lumbar. The sacrum is less than one and a half inches long, even measuring the produced pre-zygapophyses, and therefore much shorter than the ilia, which project far in front of it; it ends opposite the posterior margin

of the acetabulum. The axis of the neural canal, like that of the spinous processes, is gently convex; but such is the disparity in size between the two anterior and three succeeding centra that the face of the bone is strongly concave.

The *caudal* vertebræ are eleven in number, of which the first six are perforate with a neural canal, the remainder being imperforate. The series measures one and three-fourths inches, only about half of which length projects from the body to constitute the tail-measurement of zoölogists. There is no trace of spinous processes on any of these coccygeals, the superior median line being formed by the neural arches, apparently bifid in front, where the forking pre-zygapophyses embrace the less-produced post-zygapophyses; with the subsidence of these formations on the 7th caudal, the vertebræ articulate by their centra alone. The transverse processes, of undetermined homology, are all distinct from each other as far as they occur at all; they are largest on the 2d caudal, where they form thin horizontal plates as long as the body of the bone, triangular in outline, the prominent angle posterior. The centra successively decrease in size in every dimension, from first to last; no processes of any sort are fairly recognizable after the 9th vertebra, and the terminal one is a minute, conical, acute bone about one-tenth of an inch long.

*Thorax.*—This is strongly conical, much contracted anteriorly, dilated and capacious posteriorly in that portion which lies behind the sternum, covering abdominal organs. The *sternum* is about two inches long and very narrow, except at the top. It consists of six sternebrae of nearly the same width (excepting the manubrium), but successively graduated in length. The intermediate pieces are similar to each other in their somewhat hourglass-shape, being constricted in the continuity, expanded at each end; the outer surface has a more or less conspicuous longitudinal median ridge; the inner surface is flat. The last sternebra, or xiphoid, ends with a flat rounded extremity, supplemented by a very slight cartilage, if any. The manubrium is much the largest of the sternebrae, with the best marked longitudinal ridge on its exterior face, and much the strongest lateral processes for articulation with the first pair of ribs, the bone being here more than two-thirds as broad as long. There is a distinct episternal process, like a flat, oval disk, sessile on top of the manubrium, bearing lateral facets for articulation with the clavicles, which is effected with the interposition of well-marked inter-articular fibro-cartilages.

There are *thirteen* pairs of *ribs*. The first ten ribs articulate doubly with the spinal column by both head and tubercle; the last three by the head alone, there being no processes for articulation with a tubercle on the last three dorsal vertebrae. The first nine ribs articulate by demi-facets at the ends of the centra of two contiguous vertebrae, the first demi-facet being upon the *seventh cervical*; the last four ribs articulate by full facets upon the anterior margin of the corresponding last four dorsals. Seven ribs join the sternum by means of their respective costal cartilages; the first articulating at the top of the manubrium with the apices of the lateral process, the second to sixth at the successive nodes between two sternebers, while the end of the seventh reaches the sternum at the same point as the sixth, perhaps without true articulation, and certainly having no separate place of jointure. The eighth falls but little short of the sternum; the rest rapidly shorten. All the ribs bear costal cartilages, excepting, possibly, the thirteenth (last) one, which appears destitute of one. Taken either with or without their respective cartilages, the ribs rapidly increase in length from the first to the seventh or eighth, and then less rapidly decrease again, though the last, apparently a mere spicule without a cartilage, is abruptly shorter than the twelfth. Their curvature decreases continuously from first to last, and, in the same ratio, distinctness of parts, including obliquity of neck to main shaft, diminishes; their tenuity increases from first to last. The bony part of the first rib is only half an inch long; the cartilaginous part is half as much more; these together complete about a semicircle. The bony part of the eighth is over two inches long; its cartilage is about one and three-fourths inches. On the anterior ribs, the neck stands very obliquely away from the shaft, the capitulum and tubercle being both well marked. On the succeeding ribs which join the sternum, the neck simply continues the general curve of the shaft, here very considerable. On the floating ribs, the neck similarly continues straight from the shaft, but the curvature is very slight. The under surface of most of the ribs shows the groove for the vessels; the posterior border is sharp; the anterior rounded; the sternal extremity expands and flattens (especially on the more posterior ribs) for the articulation of the respective cartilages.

*Scapular arch*.—The *clavicle*, about 1.10 long, is perfect, with articulation at each end; it is somewhat *f*-shaped in one profile, considerably curved, as well as flattened, at the acromial end, which terminates with oblique articular face—the flattened part a little convex on one side and flat on the other—

and knobbed at the sternal extremity, where the cross-section would be decidedly triangular.

The *scapula* is about 1.75 inches long by 0.90 broad at the widest part, and presents numerous well-marked features. The general contour is that of an inequilateral triangle with the postero-superior corner rounded off, and the anterior angle produced into a neck. The lower border, which is much the longest, is nearly straight; the posterior curves gently upward and forward, and is as long as the superior, which, at first convex, then curves with concave outline to the superior border of the glenoid. The ventral surface is uneven, being marked by a median line of impression, indicating the root of the spine on the opposite face, and by two radiating ridges on either side of the median line; while there are also two other ridges, one running the whole length of the superior border, the other marking a small part of the inferior border near the postero-inferior angle. Thus the bed of the subscapularis muscle is divided by these four ridges into three compartments. The dorsum of the blade is quite smooth and nearly flat; the very prominent spine, running the whole length of the bone, divides this surface into an upper, broader but shorter, and an under, longer but narrow, portion for the supraspinatus and infraspinatus muscles respectively. The plate of the spine is perpendicular to the body of the bone; its free edge is strongly convex throughout, the height of the spine at its middle being nearly as great as at its acromial end, and somewhat sinuous from deflection of the plane of the spine out of the perpendicular; the greatest height is about 0.50, or more than half the greatest width of the bone. At its fore end, the spine develops a well marked prominent acromial process, reaching forward and upward, the plane of which is twisted nearly at right angles with that of the rest of the spine. The fore edge of the spine is a strongly concave line running from the neck of the scapula to the apex of the acromion. The neck of the bone is well marked; the lower part of the shallow glenoid fossa is nearly circular, but the articular surface is much produced above, giving a somewhat pyriform shape to the outline of the whole cavity. There is a conspicuous coracoid, projecting hook-like from the supero-interior corner of the glenoid.

*Bones of the fore limb.*—The *humerus*, about 1.75 long, is a stout bone, straight on the whole, but with numerous salient points and ridges. The articular head, rather less than hemispherical, and not circular in section, being longer than wide, is sunken between prominent greater and lesser

trochanteric tuberosities, without appreciable neck. There is a strong deltoid ridge, running down from the greater or external tuberosity, and terminating in a stout, prominent, roughened tubercle just above the middle of the shaft, from which a slighter ridge runs down to the inner side of the ulnar articular facet. Below, the bone flattens and widens laterally to a breadth of 0.60. From the external condyle, a sharp ridge curves backward and upward to subside on the shaft at the middle of the latter; the inner condyle projecting laterally much farther from the articular facet than the outer one, though no such condylar ridge is prolonged up the shaft of the bone. This condyle is perforated with a large canal, oval in section, formed by a bony trabecule thrown across in front. The ulnar portion of the articular facet, lying in the main axis of the bone, constitutes, as usual, a simple ginglymoid joint, being very convex antero-posteriorly, concave in the opposite direction; its inner edge is ridged, its outer continuous with the radial articular surface, which latter is convex in all directions. Just above the joint, at the back of the bone, there is the usual pit for the reception of a process of the ulna; but the bone is not here perforate, though very thin. The position of the articular surfaces allows strong flexion of the forearm, but scarcely permits complete extension.

The *ulna*, two inches or more long, presents a strong olecranon extending back of the joint to a distance greater than the length of the articular surface. The latter is a semicircular nick, very oblique in position with reference to the axis of the bone; the facet for the articulation of the radius is distinct. On its inner face, the shaft is deeply grooved for the reception of the radius, which lies in close apposition with the ulna for the whole of its own length; but the ulnar groove continues up beyond the head of the radius. On the inner face of the bone, a somewhat similar groove runs from the side of the olecranon past the joint, but soon becomes obsolete. The ulna ends below with a simple conical extremity, which takes but little share in the formation of the wrist-joint.

The *radius*, about 1.60 long, lies close to the ulna its whole length; the shaft is much bent outward; the head is oval in section, with a cupped facet for humeral articulation, and smooth, convex, lateral facet for the ulnar joint. The tubercle for insertion of the biceps is recognizable. The lower extremity is enlarged, bearing an oval facet, the outer corner of which is produced as a slight process. Notwithstanding the restriction of motion

which the close apposition of the ulna and radius would indicate, the relations of their various articular surfaces are the same as those in cases where pronation and supination are perfect, and such movements are doubtless considerable in extent.

*Manus.*—The *carpals* are nine in number, in two rows, four in the proximal and five in the distal series. The first bone of the proximal series, on the radial side, develops a large, flat, falcate process as long as the 1st metacarpal, against which it lies; this process supports the outer one of the two large palmar tubercles at the radial side of the hand.\* The second bone of this series, lunare if not scapholunare, is also of great size, irregularly semi-lunar in shape, with an oval convex facet, which forms most of the radio-carpal articulation. The outer two bones are much smaller. In the distal row, one of the five bones is probably an "os intermedium"; this and three of the others are extremely small; the remaining larger bone is somewhat uncinat.

There are five *metacarpals*, of which the 1st is much shorter than the rest, and directed obliquely away from them; the others are approximately parallel; the ratio of their lengths is 3d, 4th, 2d, 5th, the last shortest. There is the normal number of *phalanges*—two in the pollex, three in each of the other digits.

*Pelvis.*—The sacral portion of the pelvis has already been described with the vertebrae. The *pelvis* is rather long, narrow, and parallel-sided, about two and a half inches long from apex of ilia to the opposite extremity. The general axis of each innominate bone is straight. The ilia project about one-fourth of their length in advance of the sacrum (which terminates opposite the posterior border of the acetabula); their anterior prolongations embrace the whole of the last lumbar vertebra. The ilia are narrow trihedral bones, curving anteriorly outward, and somewhat clubbed at the extremity; the edges are all sharp, but the superior border is especially prominent; the outer surface is concave; the other two faces of the bone are flatter, the internal being roughened for the sacro-iliac synchondrosis. The shaft of the bone is constricted just above the acetabulum, though still markedly triangular in section. The acetabula are deeply cupped, surrounded by a prominent rim, except posteriorly, where the lip of the cup sinks into a deep notch. The ischial

\* In the Beaver, there is said to be a large "accessory" carpal ossicle. It may be that the bone here described is the homologous ossicle of *Haplodon*, which, if substantiated, would furnish additional evidence of affinity between this genus and *Castor*.



and pubic rami enclose a very large obturator foramen, of subtriangular shape, but with all the corners rounded off. The "horizontal" and "descending", in this case nearly anterior and posterior, rami of the pubis, are about equally slender, notably more so than the ischium; the descending ramus is at a right angle with the ischium. There is a well-developed tuberosity of the ischium, but no notch in the bone above it. The pubic symphysis is short, and the connection of the bones slight.

*Bones of the hind limb.*—The *femur* is a stout straight bone about two inches long, the shaft much flattened, the distinction of parts at either extremity well marked. The globular head represents more than a hemisphere; it stands off from the shaft at an angle of about  $45^{\circ}$ , upon a constricted but short neck. It bears a well-marked pit, denoting the insertion of the ligamentum teres. The trochanter major is very prominent, rising as high as the head of the bone, a deep notch intervening; there is a conspicuous fossa on its posterior face, while from its outer aspect a prominent "gluteal" ridge runs nearly half way down the shaft of the bone, like the corresponding "deltoid" ridge of the humerus. There is a strongly marked lesser trochanter—a tubercle on the postero-internal aspect of the shaft, just below the neck of the bone, prolonged downward as a sharp ridge. No third trochanter is recognizable. The condyles are well formed; the inner is larger than the outer, reaching farther down, especially farther back, and being decidedly thicker across; its articular surface is, however, narrower. Behind, the condyles are separated by a deep notch; in front, a trochlear surface (broad groove) for the play of the patella reaches far above the portion of the joint which enters into the tibial articulation proper.

There is a large sesamoid bone in the knee-joint, the *patella* being one-third of an inch long, of conico-triangular shape, with smooth concavo-convex posterior face for articulation with the femoral trochlear groove which surmounts the condyles in front.

Of the two bones of the crus, the *tibia* alone enters into the construction of the knee-joint, the head of the fibula being much below the articulation. The tibia, as long as the femur or slightly exceeding it in length, is straight when viewed from the front, but from the side shows a decided *f*-shape, having an anterior convexity above and corresponding posterior bend below. The lower half of the shaft is smooth and cylindrical, but the upper develops two large crests, one anterior, like the "spine" of the human shin-bone, the



other directly posterior; the latter shorter than the former, but thinner and sharper-edged. The inner expanded surface of the bone between these two crests is smooth and convex; the opposite side presents two hollowed surfaces (the posterior one especially excavated) divided by a ridge which runs out to the point of tibio-fibular articulation. The head of the bone on top is triangular, the anterior angle represented by the tuberosity for attachment of the extensor tendon. The great part of this space is occupied by the articular facets, of oval shape, the outer one rather larger than the inner, the two being separated almost entirely by an intervening non-articular groove. The most protuberant outer corner of the head of the bone bears a small cupped oval facet, entirely separate from the knee-joint, for the articulation of the fibula. The enlarged lower extremity has its articular face divided antero-posteriorly by a ridge into two principal facets; similarly, the inner malleolus is emarginate, presenting two (an anterior and posterior) bony prominences instead of a single directly lateral nodule of bone.

The *fibula*, so important a bone for purposes of classification among Rodents, is here perfect and entirely free from bony connection with the tibia. Nevertheless, in its lower fourth or third it is closely apposed to the tibia (that portion of the tibia which bends outward and backward) and firmly bound in such position, apparently capable of little, if any, independent movement. I have not taken occasion to examine for myself the state of the parts in *Castor*; but in that animal, in which the fibula is apparently described with propriety as "perfect" and "free", bony union is said to sometimes occur in old individuals; and I should not be surprised if such were the case with *Haplodon* also. But, in any event, such superimposed, or, so to speak, fortuitous and progressive consolidation, is not to be confounded with the complete true anchylosis which is characteristic of the *Myomorpha*. The fibula is a perfectly straight bone (excepting a slight inclination toward the tibia below), with very slender shaft, less than two inches long, with an enlarged narrowly oval head, only a small part of which is articular, and with a well-formed, irregularly triangular malleolus, the inner aspect of which forms part of the ankle-joint. A small extent of the shaft is roughened for ligamentous connection with the tibia opposite a similar and more extensive roughened space on the latter bone.

*Pes*.—There are eight true *tarsal bones*, besides a supplementary ossicle which I do not recognize. The large calcaneum reaches far back; the

anterior extremity is somewhat three-pronged; the inner anterior corner forms a broad shelf, upon which the inner half of the astragalus is imposed. The astragalus has a well-marked trochlear surface for the tibia, and a large forward projection, or plate-like process, upon the convex oval extremity of which the lenticular naviculare is articulated by a cupped facet. A large os intermedium or centrale is wedged in between the naviculare and the row of cuneiform bones. The latter are three in number, side by side, bearing upon their proximal faces the centrale, and supporting at their distal ends the 1st, 2d, and 3d metatarsals. An irregularly nodular cuboid supports the 4th and 5th metatarsals. On the inner side of the inner cuneiforme, and at the base of the 1st metatarsal, may be observed a small flattened and somewhat semilunar ossicle close-pressed to the side of the foot.

There are five metatarsals; the three intermediate ones are of approximately equal lengths; the 5th is a little shorter, the 1st shorter still, but not so much reduced as the 1st metacarpal. The head of the 2d metatarsal is locked in a recess between the two lateral cuneiform bones.

There are fourteen phalangeal bones, disposed as in the hand; two to the hallux, three apiece to the other digits.

The os hyoides and os penis are described in speaking of the soft parts of the organs to which they respectively pertain.

#### D.—DESCRIPTION OF THE VISCERA.

*Heart.*—The heart is an inch long, not peculiar in shape. Both auricles are very distinct, standing flap-like away from the ventricles, or only connected by a constricted pedicellate base, especially the left one. In the state observed, they were engorged with blood-clot; the ventricles were empty. The right ventricle is much thinner-walled than the left; the aorta arches to the left over the pulmonary artery, which at first is directed to the left, and then backward beneath the arch of the aorta, where it divides to right and left, proceeding to the lungs.

*Respiratory organs.*—There is a well-developed *larynx*, in which the principal parts are completely cartilaginous. The thyroid is the largest of these, somewhat semilunar in general outline, but with a median superior projection, median inferior emargination, and rather long, slender postero-inferior corners, which are firmly attached to the lower border of the cricoid at each side of the latter. The cricoid is large, stout, and completely

cartilaginous,—the only cartilage that entirely surrounds the wind-pipe. It is infundibuliform, the diameter of the ring being considerably greater above than below; and it is not so high in front as behind, where it bears the arytenoids. These are well developed, entirely cartilaginous, and of an irregular shape, impossible to describe concisely; when in mutual apposition, they reach nearly half way across the top of the cricoid ring.

The *trachea* is flattened, especially behind, and diminishes somewhat in calibre as it passes down, ending in the bronchia with a simple bifurcation. None of the tracheal rings are cartilaginous posteriorly, the membranous portion being nearly the semi-circumference. These half-rings are about thirty in number; of the similar bronchial half-rings, there are five or six to the first bifurcation. The tracheal cartilages are not regular, either in position, size, or shape; some are not directly transverse to the axis of the tube; some are thicker than others; and some are partially divided into two on this or that side. The tube is about two inches long. The left bronchus is rather longer than the right.

The *lungs* appear to be very small in comparison with the size of the animal. In the collapsed state observed, and with the lobes placed as nearly as possible in the natural position, the left lung was less than one and a half inches long; the right was a little more. The two differ remarkably in their lobation (at least in the specimen examined). The left lung consists of only two lobes, the lower much larger than the upper; they are almost completely separated, only connected by a thin band of parenchymatous tissue; each receives a fork of the bronchus. The right lung is much more complicated, being divided into *four* very distinct lobes, each of which receives its own branch of the bronchus; as in the case of the left lung, the parenchymatous connection of the lobes is slight. The third lobe counting from above is the principal one, representing more than a moiety of the lung. Above and to the front of this main lobe, overlying it much as the auricles of a heart rest upon the ventricles, are two small narrow and thin lobes, side by side, of about equal size and similar shape. The fourth lobe lies on the inner back side of the main one, and equals it in length; but it is very thin and "straggling", having about the same capacity as one of the small upper lobes. This lobe has but the slightest parenchymatous connection with the main lobe, and is furthermore itself lobulated.

*Digestive organs.*—Within the apparent edges of the lips short fine

hair extends some distance, upon modified papillate integument, well defined from the smooth naked mucous membrane proper. Near the angle of the mouth, on the upper lip, there is a curious patch of hair growing upon an island of papillate modified integument like that of the edges of the lips, but entirely separated by a strait of smooth mucous membrane. The roof of the mouth presents a singular series of elevations and depressions, very unlike the regular transverse ridges and lines of impression seen in many mammals. There is a smooth pad-like eminence just behind the superior incisors, constricted across the middle by an emargination on each side. Behind this is another larger prominence, constricted across the middle, with regular convex termination posteriorly, and jagged edges anteriorly, joined with the first pad by a narrow furrowed isthmus, but separated behind from succeeding elevations by a deep sulcus. These formations are all anterior to the molars; the molar interspace, with a short interval anterior to these teeth, is wholly occupied by a series of paired prominences, or two rows of flattened oval papillæ of large size, five or six pairs. These pads rise nearly to the level of the molar crowns.\*

The *tongue* is thick and fleshy, rounded at the end. Only a small portion is visible from the front, but the member is about two inches long, measured from tip to the epiglottis; it is nearly parallel-sided, and about one-third of an inch in breadth, the free portion, however, widening to half an inch or more. The dorsum of the tongue is thickly covered with papillæ of different kinds. Anteriorly, the papillæ are villous and innumerable; behind, these gradually change into flattened tubercle-like projections. The villous portion of the tongue shows a large number of "conical" papillæ, irregularly scattered, while posteriorly there are a few large and distinct "circumvallate" papillæ. The pharynx is much contracted. A well-formed but soft and rather narrowly semilunar epiglottis guards the laryngeal orifice, more complete closure during deglutition being apparently effected by a forward movement of the opposite side of the aperture. The rima glottidis is posteriorly a simple cleft, or chink, between the apposed arytenoids.

There is a large *hyoid* bone, entirely osseous, excepting the glosso-hyal, which extends forward into the substance of the tongue as a gristly rod. The basi-hyal is broadly V-shaped, with an anterior protuberance beyond the angle of the V. There is no uro-hyal. A slender bony style, over half an inch

\* I do not know how much these appearances may be due to immersion in alcohol. In another specimen, the posterior part of the roof of the mouth is quite smooth.

long, suspends the hyoid from the back part of the skull; and there are other shorter, but still well-developed, "cornua".

The *salivary glands* are of enormous size.\* On removal of the skin, these glands present most conspicuously as a great mass across the throat, completely filling the space between the jaw and the thorax, and between the corner of the skull and point of the shoulder to the general contour of the body at this part, and dipping deep behind and above the angle of the skull, where it lies against the base of the skull. It is this glandular mass that largely contributes to lack of distinction of neck observable in life, and to the rendering of the circumferential measurement of the head behind the ears as great as that of the body behind the shoulders† The two lateral glands, which meet, but do not fuse, on the middle line of the throat, are the parotids. Excluding the deep-seated portion beneath the mastoid and auditory bullæ, the glands form a flattened mass of irregular shape, the posterior border adapted to the contour of the shoulder and thorax, the anterior similarly fitted to the jaw. The duct proceeds from the anterior border, from a point opposite the angle of the jaw, and lies superficial upon the masseter, running forward along the middle of the mandibular part of this muscle, to empty in the mouth near the commissure of the lips. Lying deep-seated, covered by the mass just described, is found another pair of salivary glands, perfectly distinct, about three quarters of an inch long, of a flattened amygdaloid shape. These are the submaxillaries; they are in relation with the muscles of the root of the tongue and inner border of the jaw, and the duct appears to open on the side of the tongue near its base.‡

The *oesophagus*, measuring about five inches in length, is a simple tube, of uniform small calibre, peculiar in no respect; it pierces the stomach at a point midway between the pyloric and cardiac ends.

The *stomach*, undistended and lying smoothly, flat on its side, appears like a thick V, or still more like the conventional heart (on a pack of playing cards for example), though with gently rounded angle, and with longer upper ends and deeper emargination than those of the figure just suggested. The

\* Apparently much as in the Beaver, and further indicating affinity between *Haplodon* and *Casior*. The salivary glands "are enormous in the Beaver, extending from before the ears forward and downward to contact with the submaxillaries, which are about one-twentieth their size; the whole forming a sort of glandular collar".—(OWEN, Comp. Anat. and Phys. Vert. III, 399.)

† The large mass of nuchal muscles on the back of the neck make the line from the occipital crest to the shoulders straight.

‡ There is a large lachrymal gland. The eye-ball is very diminutive, about an eighth of an inch in diameter—it could easily be inserted into the meatus of the ear.

œsophagus enters at the notch. On inflating the organ, the elongated tapering cardiac extremity curls like a horn around to the right, and comes in apposition with the pyloric end, when the stomach appears doubled on itself; in fact, the two ends pass each other for an inch or more. The greater curvature of the stomach is then nearly circular, the line of the short upper border being a spiral. The cardiac end tapers gradually to a blunt, rounded extremity; the pyloric portion is much shorter; there is a well-marked pyloric constriction near the end. The organ may be distended to measure about eleven inches around the greater curvature, with a maximum diameter of three inches and a depth of two. The pyloric portion of the stomach is thicker-walled than the cardiac prolongation, and, as well as can be determined with a hand-lens of low power, much more highly glandular; the lining of the cardiac compartment being similar apparently to that of the œsophagus. I observe no fold of membrane to constitute a pyloric valve, though there is a constriction of the whole organ, apparent from the outside, close by the pyloric end.

When the convolutions of the *small intestines* are straightened out without undue stretching, and the bowel is moderately distended, this portion of the digestive tract measures about six feet in length, with a uniform calibre of half an inch or more. There is no distinction of duodenum, jejunum, and ileum. The ducts of the pancreatic and hepatic secretion pierce the intestine close to the stomach; the latter duct about an inch from the pylorus. The ileum pierces the colon at a right angle. A circular fold of mucous membrane forms a valve to guard the entrance.

There is an immense *cæcum*, at least a foot long, and very capacious. In its most dilated portions, about the middle, a section of it equal to the stomach in length would contain quite as much as the latter. The extremity tapers, ending bluntly, without a vermiform appendage (very naturally). This portion of the alimentary canal makes several convolutions when *in situ*; it is sacculated throughout, or with alternate constrictions and dilations, like the human colon.

The length of the remainder of the digestive tube is about five feet,\* measured as already said. This portion of the canal presents no distinction of colon and rectum. It is of uniform calibre throughout, or nearly so, and not much more capacious than the small intestine—perhaps half as much

\* Making the total length of the intestinal tract about eleven feet. The animal being about a foot long, it follows that the intestines are about eleven times as long as the body.

again in diameter; and it further resembles the foregoing portion of the tract in the total absence of sacculation. I find nothing answering to a "sigmoid flexure"; but, for much of its length (two feet or more), the gut doubles on itself when *in situ*, being closely bound by a fold of mesentery not broader than the diameter of the intestine itself. In the specimen examined, the contents of the bowel had begun to separate into faecal pellets about two feet from the anus, these masses finally assuming an ovoidal shape.

The *pancreas* is a small organ, and very slender; it lies in the usual site, and its duct empties near that of the liver.

The *liver*, of moderate size, is quadrilobate; the four lobes being as distinctly marked as those of the lungs, already described. The principal or cystic lobe is superior, and much the largest one; it is about  $2\frac{1}{4}$  inches across (side to side of the animal) by  $1\frac{1}{4}$  in the opposite direction, and irregularly oval, or rather trapezoidal, in shape, with a decided emargination of the front border near (to the left of) the gall-bladder. It is rather flat and thin for its length; the superior surface is smoothly convex, apposed to the diaphragm; the under is irregularly flattened, being moulded upon the sub-cumbent lobes. About the middle of the right half of this lobe lies the gall-bladder, of large size (about that of a small almond); its fundus reaches the fore border of the lobe. Beneath this main lobe, on either side, and partly covered by it, lie the two next largest lateral lobes, right and left, having very little connection by hepatic substance with each other or with the main lobe. The right one is the smaller of the two, very flat, and irregularly circular; the other is likewise subcircular in most of its outline, but it sends off a long tapering process, which reaches over into the left hypochondrium. The remaining Spigelian division of the liver might in fact be described as two, since it consists of two "tails", or processes, of hepatic substance, an inch or more in length; one, much larger than the other, and is itself bilobate; the smaller one, an extremely delicate process, about an inch long, lies, when *in situ*, in relation with (behind) the pyloric portion of the stomach. The cystic and hepatic ducts unite in a short (about half an inch) ductus communis choledochus, which empties in the duodenum an inch from the pylorus.

*Genito-urinary organs.*—The *kidneys* are rather oval than of the shape most familiar to the human anatomist, and which the name "kidney" is used to suggest in other connections; they are about an inch long by two-thirds as broad. The right kidney lies rather higher up than the left, its apex being



nearly opposite the last rib. The ureters pursue the usual course, to open at the side, near the base, of the urinary bladder, which is of large size. The kidneys are capped by well-developed adrenals, which are slender bodies, about half an inch long.

In the condition observed, the *testes* are abdominal, lying in the large inguinal canal, not bulging beyond the general plane of the obliquus externus muscle, and consequently causing no visible swelling of external parts. There is no proper scrotal dilatation of the integument; though in the periodical increase in size, which the organs doubtless undergo, and their presumed descent some way through the inguinal ring, it is supposed the organs may cause some turgidity of the exterior contour. The testes are enveloped in a conspicuous muscular tunic, an incompleated cremaster, given off from the transversalis abdominis. The body proper, in the state observed, is less than an inch in length, of narrowly oval shape, invested with a firm whitish tunica albuginea; but the organ has a long tapering prolongation upward, while at the lower extremity is the small mass of the epididymis. The vas deferens ascends the border of the testes part way before leaving the organ to pursue a nearly straight course to the urethra, where it empties close to its fellow, at the middle line of the large transverse gland, which embraces the base of the urethra posteriorly.

The muscular crura of the *penis* are plainly traceable to the tuberosity of the ischium, fibres arising most of the way along the pubic as well as ischiatic ramus. The præputial sheath of the penis is freely movable along the whole length of the os penis. This is of large size, and in the inactive state of the member is directed backward, causing the tegumentary investment of the organ to project conspicuously, as already noted in describing the external parts of the animal. The bone is about an inch long (0.80 in the specimen examined), straight and flattened, widening regularly and gradually from base to tip, where it is enlarged, with a clubbed and deeply bifid extremity; this end of the bone suggesting the condyles of a femur, though its cleft is much deeper. The dorsum is smoothly convex from side to side; the urethral surface of the bone is sulcate; the basal extremity is emarginate. The bone appears to continue to the very end of the organ, no glans penis being evident.

*Muscles.*—I add notes on a few of the muscles, as incidentally observed during the examination of the viscera.



The temporal muscle is of moderate bulk, the fossa being comparatively shallow. The masseteric and pterygoid masses are of great size. The masseter forms a bulging mass on the outside of the jaw, completely filling the great fossa formed by the outward twist of the angle of the jaw, and defined in front by an oblique ridge already described in speaking of the bone. A special stout tendon arises from the zygomatic process of the maxillary, just below the anteorbital foramen, which latter opening, notwithstanding its small size and apparently inconvenient relations, transmits a small fascicle of the masseter along with the superior maxillary nerve.

The muscles acting upon the hyoid bone, both from the thorax and from the jaw, are well developed. A pair of stout fusiform muscles connect the hyoid with the back of the skull. I find no trace of direct muscular connection between the hyoid and the scapula (omo-hyoid). Sterno-mastoid and cleido-mastoid are well developed, and distinct from each other for nearly, if not quite, all of their extent, though their thoracic insertions are very near together.

The diaphragm is very thin, even its most muscular portions, and a large part of it is simply membranous. There is a large, well-defined, central "tendon", as broad as the muscular portion on either hand. This is of oval shape in most of its extent, but with two posterior prolongations, one on each side, separated by the fleshy "pillars" which arise from the vertebræ, and proceed to embrace the œsophageal orifice. Muscular fibres are scarcely or not developed laterally behind, where simple membrane may be traced to the insertion of the organ along the floating rib. The radiating muscular portion of the diaphragm, then, is a single set of fibres arranged in fan-shape around the anterior oval portion of the central tendon; these fibres are continuous on the median line in front. The aortic opening, as usual, is close to the vertebræ; the œsophageal aperture is removed from the spinal column by the whole length of the muscular pillars. From the middle line of the diaphragm depends a broad peritoneal fold, suspending the liver, to which, more posteriorly, it is closely adapted.

#### E.—HISTORY AND HABITS OF THE SPECIES.

To render the account of this remarkably interesting animal more complete, I shall, in tracing its history, include some notices of its habits. I have already presented those considerations which bear upon the history of the genus and family.

The Sewellel was discovered\* in 1805 or 1806 by the famous travellers Lewis and Clarke, whose account first appeared in 1814, in the Biddle-Allen narrative of their expedition (2 vols., 8vo, Philadelphia, Bradford and Inskeep), and nearly simultaneously in the Rees English edition of the same date (1 vol., 4to, London†). The notice by these authors runs as follows:—

"Sewellel is a name given by the natives to a small animal found in the timbered country on this [*i. e.* Pacific] coast. It is more abundant in the neighbourhood of the great Falls and rapids of the Columbia, than on the coast, which we inhabit.

"The natives make great use of the skins of this animal in forming their robes, which they dress with the fur on, and attach them together with sinews of the elk or deer: the skin, when dressed, is from fourteen to eighteen inches long and from seven to nine in width; the tail is always separated from the skin by the natives in making their robes.‡ This animal mounts a tree,§ and burrows in the ground, precisely like a squirrel:¶ [Description here follows.] . . . Captain Lewis offered considerable rewards to the Indians, but was never able to procure one of these animals alive." (Quoted from text of the London 4to ed.)

Upon the Sewellel of Lewis and Clarke was actually and entirely based the *Anisonyx rufa* of Rafinesque, who also gave names to others of the species first described under vernacular names by these travellers. I have already discussed the bearing of the term *Anisonyx*, and need not repeat that it is a synonym of *Cynomys*, Raf., whose "*Anisonyx brachiura*" was based upon the "Burrowing Squirrel" of Lewis and Clarke, as "*Anisonyx rufa*" was upon their Sewellel. Notwithstanding that the term was invented upon an erroneous interpretation of the meaning of Lewis and Clarke, and was applied to two animals of widely different genera (*Cynomys* and *Haplodon*), it seems that Rafinesque's specific term *rufa*, being based exclusively upon the Sew-

\* Sir John Richardson is inclined to think that a passage in a much earlier work (Mackenzie's Voy. to the Pacific, &c., p. 314) refers to the Sewellel. "Sir Alexander Mackenzie saw many animals, which he terms 'moles', on the banks of a small stream near the sources of the Columbia; but as we are led to infer, from the way in which he speaks of them, that they were in numbers above ground, I am inclined to think that they were sewellels, belonging to the genus aplodontia . . ."—(*Fn. Bor.-Am.* 4, 1889, p. 11.)

† For "An account of the various publications relating to the Travels of Lewis and Clarke, with a commentary on the Zoological Results of their Expedition", prepared by the present writer, see Bull. U. S. Geological and Geographical Survey of the Territories, No. 6, 2d ser., pp. 417-444 (8vo, Washington, Government Printing Office, February 8, 1876).

‡ But cf. Sir John Richardson, as quoted beyond.

§ Doubtless an erroneous statement, as supposed by Audubon and Bachman, and later by Gibbs and Buckley.

¶ The "burrowing squirrel" of Lewis and Clarke was a *Cynomys*.

ellel, should be retained; for, however faulty the characterization of the genus may have been, this in no way invalidates the specific designation. The name *rufa*, in fact, has been adopted by at least two writers, Harlan, in 1825, and Griffith (1827), who transferred the animal to the genus *Arctomys*. Professor Baird\* uses the following language respecting this matter:—

"It is perhaps a question whether the true name of this species be not *Aplodontia rufa*, after Rafinesque. Although his description is incorrect, it was based on the Sewellel of Lewis and Clarke, which is unquestionably the *Aplodontia leporina* of Richardson. As, however, Rafinesque asserts positively that certain characters apply to his *Anisonyx rufa*, which really do not exist in *Aplodontia leporina*, we may be warranted in avoiding the use of his specific name for Richardson's animal. It may, perhaps, be well to repeat that Rafinesque bases his description entirely upon a partly erroneous interpretation of the article of Lewis and Clarke."

Although this is perfectly just criticism, it should nevertheless be borne in mind that *Anisonyx rufa* has a definite and well known basis, whatever the inapplicability, insufficiency, or other fault of the accompanying diagnosis may be; and, consequently, a rigid constructionist cannot well avoid the use of the specific term *rufa*. Naturalists constantly adopt and retain scientific names given upon a known basis, even when such names are unqualified by diagnosis; and it seems to me that the admitted flaws of Rafinesque's description are scarcely valid cause for the rejection of his name. *Anisonyx* itself is to be thrown out rather upon consideration of the fact that it is chiefly a synonym of the same author's *Cynomys* than on account of its own intrinsic demerits.

The second period in the history of the species began in 1829, upon the introduction of the *Aplodontia leporina* of Richardson, characterized in the Zoölogical Journal, and the same year more fully described, with figures of the skull and teeth, in the Fauna Boreali-Americana. These were the first full and accurate accounts of the genus and species under a scientific designation, and long remained the source of inspiration to the compilers and other second-hand writers. Sir John Richardson's material was received, like many other specimens of mammals and birds described by him, from Mr. David Douglass (or Douglas—I find the name thus differently spelled), and is supposed to be that upon which Audubon's subsequent description and

\* Mamm. N. Amer. 1867, 354.

figure were based. In concluding a lengthy and elaborate description, both of the genus and species, Richardson alluded to the possible existence of a second species\* in the following terms:—

"Amongst Mr. Douglas's specimens, there is a young one, with more white hairs interspersed through its fur, and some differences in the form of its skull, which seem to point it out as a second species. The breadth of its frontal bone, between the orbits, where least, is six lines, being twice the breadth of the same bone in *A. leporina*. Its nasal bones are as broad as in the latter, but are three lines shorter. The dentition is perfectly the same in both, but in the young specimen there is a new set of grinders in the lower jaw, which have destroyed the bodies of the old grinders, leaving merely a long process before, another behind, in each socket, resembling fangs. The specimen is not sufficiently perfect to enable me to give its characters as a distinct species, but I have little doubt of its being so."

It is scarcely necessary to state that the supposed existence of a second species has never been verified. While there is something in this account of the inferior molars not readily intelligible, the cranial differences noted may be ascribed to the immaturity of the specimen or its individual variability. The author continued with an account of some color-variation observed in the skins of a robe, leading him again to the inference that there were two species of Sewellel:—

"Since the account of this species was published in the Zoological Journal, Mr. Douglas has placed in my hands an Indian blanket or robe, formed by sewing the skins of the sewellel together. The robe contains twenty-seven skins, which have been selected when the fur was in prime order. In all of them the long hairs are so numerous as to hide the wool or down at their roots, and their points have a very high lustre. The general colour of the surface of the fur is between chestnut and umber browns, lighter, and with more lustre on the sides. Some of the skins, which are in the best order, have the longer hairs on the back of the head, and between the shoulders almost black. It is probable, however, that these are the skins of two species of sewellels, in the robe, and that one of them wants the white mark on the throat. The down of all the skins of the robe has a shining blackish-gray colour."

The color-variation noted by Richardson may be compared with that

\* See also beyond: Dr. Peter's characterization of a new variety.

indicated by some of the later authors, as quoted beyond. From the time of Richardson's account, I am not aware that other notices of the species, based upon original observation or any new material, appeared until 1848, when Mr. T. R. Peale, a naturalist of the United States Exploring Expedition, gave another contribution to the history of the animal, based on his own experiences and collections. We may therefore pass over various compiled accounts as not material to the present history, and take up Mr. Peale's article, above cited in the synonymatic list. This consists of a description and measurements, with remarks on the abundance of the species at Puget's Sound, and on the peculiar form of the skull, which is figured on page 57. This figure, though only a slight woodcut showing little detail, well represents the general contour of the skull, and is notable as being the first representation of the whole cranium, Richardson's specimen figured having been very defective.

Shortly afterward, in 1853, appeared the general account of the genus and species, by Audubon and Bachman, as above cited. Their figure of the species was the first colored illustration of the animal, and it may be the only one extant, though the skull and teeth have been figured by Richardson, Peale, and Baird. The drawing was made by his son, J. W. Audubon, "from a fine specimen in London", presumably one of Richardson's types. These authors' notice consisted of a copy direct of Richardson's characterization of the genus, an elaborate description of the species, a quotation of Lewis and Clarke's account, a summary notice of the robe described by Richardson, and a few general remarks, chiefly historical. They alluded to *two* specimens then or lately extant in the Patent Office at Washington, being those collected by Peale, and which, they say, they were "politely refused" permission to examine.\* The collection to which the authors referred was shortly afterward (1858) removed to the Smithsonian Institution, where it now (1877) forms part of the National Museum. One of Peale's specimens (that catalogued by Baird in 1857) remains at this date, and has been examined in the preparation of the present article; the other† I have never seen, nor was more than one of them noticed by Baird.

\* Hence Professor Baird's statement, made in 1857, requires qualification. "This animal," he says, "though not rare in the vicinity of Puget's Sound, is yet very little known to naturalists, though the materials at our command are richer now than a few years ago, when Audubon and Bachman were unable to find a specimen in any museum of the United States."—(Mamm. N. Amer. 1857, 353.)

† Peale (*op. cit. supra*) speaks of his "specimens", leaving the impression that he procured more than one. Two of his skulls are in the Smithsonian. On speaking to this venerable naturalist about it, the other day, Mr. Peale told me he did not remember that he secured more than two specimens; these, however, he recollected perfectly, and he gave me some delightful gossip about the grievance which so ruffled Audubon's temper.

The last period in the history of the animal begins in 1857, with the elaboration by Professor Baird of the material gathered by the naturalists of the Pacific Railroad Explorations and Surveys, and the field-notes of the naturalists themselves, published in the vi., viii., and xii. volumes of the reports pertaining thereto. Besides Baird's elaborate article and figures, we were given copious notes on the distribution, habits, &c., by Newberry, Cooper, Suckley, and Gibbs.

In 1857, the genus and species were fully treated by Professor Baird, as far as the technical aspects of the case were concerned; his characterization, especially of the cranial and dental characters, being even more elaborate than that given by Richardson. The skull, teeth, and some points of external structure, were refigured in several views. Professor Baird's material consisted of an Exploring Expedition specimen collected by Peale, then as now mounted, and from which his account of the species was mainly derived; of three skins secured by Dr. G. Suckley at Steilacoom, Wash. Ter.; and an additional skin taken by Lieut. W. P. Trowbridge at Astoria, Oreg., together with two skulls from Puget's Sound, appertaining to Mr. Peale's specimens.

Dr. J. S. Newberry's note, published in the zoölogical portion of the vi. volume of the Reports in 1857, ran as follows:—

"This singular animal, called by Richardson [after Lewis and Clarke] the *Sewellel*, seems limited to a narrow district when compared with most of those which, with it, inhabit the region it occupies. In Washington Territory it is found from the coast to the Rocky Mountains. It is doubtful whether it will be found south of the Columbia,\* either on the coast range, in the Willamette Valley, or on the Cascades. Eastward, however, toward the base of the Rocky Mountains, it may occur. I have seen two specimens, one taken near Shoalwater Bay, Washington Territory, by Dr. J. G. Cooper,† and the other obtained near the base of the Rocky mountains, which were absolutely black, presenting a striking difference in color from those obtained by Lewis and Clark, Douglas, and others, which were brown, and of nearly the shade of the muskrat."

\* Audubon and Bachman say, without qualification, that it has "been procured in California"; and Baird remarks, "I have heard of an *Aplodontia* from the mountains of California, probably the same species, but have not seen a specimen"—possibly alluding to the statement of Audubon and Bachman, just quoted, or to some earlier account, which may have occasioned the remarks of both these authors.

† There is some misapprehension here; for (see beyond) we find Dr. Cooper saying, in 1860, that he never procured a specimen. The actual reference is probably to Dr. Suckley, who collected extensively, and was a collaborator of Dr. Cooper's.



Dr. J. G. Cooper's notice, in the second part of the xii. volume of the Pacific Railroad Reports,\* was as follows:—

"The 'Sewellel' of Lewis & Clark, appears to be an abundant animal in some districts west of the Cascade mountains, but from various causes I never could obtain a specimen. At the time of their visit to the country the Indians used the skins as clothing, and as it required a large number of skins to make an ordinary sized blanket, the numbers of the animals caught must have been great. It was caught by stone fall-traps, but with what bait I do not know, probably some root. The Indians assured me that none were found nearer to the coast than the Cowlitz valley, but as they have been obtained at Astoria, the statement was not altogether correct. They seem to prefer the soft alluvial river bottoms, where they are said to burrow, and probably thus follow down the Columbia. Now they are rarely caught by the Indians, as their skins are not bought by the Hudson's Bay Company, except when passed off on a 'green' clerk as muskrat skins. Of their habits I could learn little. An old Indian hunter, who is now a shepherd in the employ of Dr. Tolmie at Puget's Sound, told him that he had frequently seen them running over the snow in the Nisqually Valley, so that they probably do not hibernate. A young man who had kept school at Astoria told me that the children sometimes caught them about the schoolhouse, where they burrowed, and that they could be caught by running after them, as they did not run fast. When taken they did not offer to bite, and ate vegetable food readily. The specimen sent from there was found drowned in a tanner's vat."

The same volume from which Dr. Cooper's above-quoted observations were extracted contained a variety of further information, contributed by Dr. George Suckley, well known for his natural-history studies of Oregon and Washington, and by George Gibbs, Esq., the distinguished ethnographer and philologist. Among other items of their respective accounts may be specially noted Mr. Gibbs's determination of the inapplicability of the name "Sewellel" to this animal, and his observation of its curious habit of laying out its provisions to dry. Mr. Gibbs, as quoted by Dr. Suckley (p. 100 of the volume referred to), said:—

"The specimen I send you was obtained at Seattle, where it was killed in a garden. Its name, in the Nisqually language, is Show'tl. (*Showhurll*,†

\* Republished as the "Natural History of Washington Territory".

† "*Showhurll*"—sic, in the original, which I suppose to be a typographical error for an intended *Showhurll*.

Suckley.) . . . . This animal burrows extensively in the ground. It chiefly frequents spring heads in rich moist places, and is found as far up as the dividing ridge of the Cascade mountains, and on both sides of the divide. I noticed their burrows in 1853 at the top of the main Yakima pass. *Near their abodes were small bundles of some herb or plant cut with nicety and laid out on logs to dry or wilt.\** The Indians trap them, and value their meat very much as food."

On subsequent pages of the same volume (pp. 124-126), Mr. Gibbs continued:—

"I noticed burrows of the show'tl in 1853, at the top of the main Yakima Pass, in the Cascade mountains, at an elevation of 3,500 feet, and again in 1854, at the Nahchess Pass in the same mountains. . . . The Yakima Indians call it *Squallah*. Its range in the Territory is quite extensive, from high mountain elevations to near the salt water. Colonel Simmons, one of the earliest settlers in Washington Territory, confirms the statement of the Indians that the show'tl, like the prairie dog, lives in companies. He has frequently seen them sitting at the entrances of their burrows early in the morning, and whistling something in the manner of the prairie dog. Lewis and Clark say that this animal 'mounts a tree and burrows like a squirrel.' The statement that it 'mounts a tree' is probably an error. . . . I find the [*sic—lege* that] Lewis and Clark's name of Sewellel for *A. leporina* is an error. The Chinook name for the animal itself is *o-gwool-lal*. *She-wal-lal* (*Sewellel*, corrupt) is their name for the robe made of its skins."

Said Dr. Suckley, at the last-quoted pages of the same volume:—

" . . . . It is probable that the *Aplodontia*, like many other rodents, has several litters of young during the season. The Nisqually Indians, in their mythological traditions and obscure stories concerning the creation, say that the show'tl was the *first animal created with life*. I cannot find out whether they undergo a regular torpid hybernation.† The natives say that they move about a little during the winter, but *do not become decidedly active until late in the spring*. They live in burrows, in small companies of a dozen or more, and subsist on roots, berries, &c. The Indians say that the show'tl of the Cowlitz river has a *white* breast and belly. Those at Nisqually, having the under parts dark, are said to retain the same coloration throughout the year.

\* The passage I have italicized—it was in Roman in the original—is, I think, the first indication of the curious habit in question.

† The probability seems to be that they do not.



.... They are considered by the Indians to possess high gastronomic qualities. To ascertain this I had one roasted *secundum artem*. I found it excellent. .... "

Dr. Suckley gave some measurements, derived from examination of three fresh specimens, as follows:—

"Measurements of specimens."

	No. 93, ♂	No. 93, ♀	No. 94, ♀
"From tip of nose to base of tail.....	12.75†	13.00	12.25
"Vertebrae of tail.....	1.50	1.50	1.50
"From base of tail to tip of hair.....	2.37	1.25‡	2.25
"From occipital protuberance to tip of nose.....	3.00	3.00§	3.75
"Distance between ears.....	2.75		
"Height of ears posteriorly, about.....	.75		.75
"Easy girth of head, measured around the ears.....	7.36		
"Olecranon to wrist.....	2.50		2.25
"Middle nail of fore paw, about.....	.50		
"From wrist to end of longest nail.....	1.00		1.87
"Easy girth behind shoulders.....	7.12		7.75
"Extent from most projecting toe nail of hind foot to ditto of fore foot, extreme stretch.....	18.00	17.75	18.00
"From heel to end of middle toe nail.....	2.12		2.25
"Longest whiskers, about.....			3.00"

\* Collector's numbers. † Inches and decimals. ‡ Obvious misprint for 2.25. § "Nearly." || Meant for 2.75

A few years later, in 1864, Professor Peters (*l. s. c.*) described specimens from California as constituting a new variety, to which he applied the name of *Haplodon leporinus* var. *californicus*. I have seen no specimens from that region, nor is the material available at present sufficient to enable us to come to final conclusions respecting the normal rate of susceptibility to individual variation. The few specimens, however, indicate that the rate is at least as high as that which has been established for various mammals more or less closely allied; and, should such prove really the case, there would be no impropriety in considering var. *californicus* as strictly synonymous.

#### F.—TABLES OF MEASUREMENTS.

TABLE I.—Measurements of three alcoholic specimens of *HAPLODON RUFUS*.

Current number.	Locality.	Sex.	From tip of nose to—				Tail to end of—		Length of—		Elbow to wrist.	Knee to heel.	Height of ear over notch.	Longest whiskers.	Middle fore claw.	Measure of specimen.
			Eyes.	Ears.	Occiput.	Tail.	Vertebrae.	Hairs.	Fore foot.	Hind foot.						
11356	Olympia, W. T.	♂	1.60	2.40	3.00	11.00	1.00	1.75	1.75	2.20	2.25	2.50	2.75	4.50	0.50	Alcoholic.
11354	do	♀	1.60	2.70	3.00	12.00	1.00	1.75	.....	2.10	2.00	2.50	2.80	4.75	0.50	do.
11357	do	♀	1.50	2.50	3.00	11.00	1.10	2.00	1.80	2.10	2.10	2.40	2.75	4.00	0.50	do.

TABLE II.—Measurements of three skulls of HAPLONDON RUFUS.

Dimensions.	No. 392, Paget's Sound, U. S. Ex. Ex.	No. 391, Paget's Sound, U. S. Ex. Ex.	No. 379, Stillecom, Dr. Suckley.
Total length (end of nasals to occipital protuberance) .....	2.90	2.80	
Greatest width (across zygomata posteriorly) .....	2.25	2.18	
Next greatest width (across occiput) .....	2.10		
Least width (at interorbital constriction) .....	0.40	0.33	0.50
Width across post-glenoid notches .....	1.50	1.40	
Width of rostrum just in front of zygomata .....	0.68	0.68	0.60
Depth of skull at middle, excluding molars .....	0.75	0.70	0.70
Length of bony palate .....	1.65	1.65	1.65
Length of nasal bones .....			1.08
Greatest width of nasal bones .....	0.52	0.45	0.48
Length of zygoma (from anteorbital foramen to most posterior point) .....	1.43	1.40	1.40
Distance across outer margin of glenoid fossa .....	1.48	1.43	
Length of auditory bullae .....	0.90		
Length of upper molar series .....	0.70	0.70	0.70
Width of intermolar portion of palate, about .....	0.30		
Length of incisive foramina .....	0.25	0.25	0.20
Horizontal diameter of foramen magnum (the vertical about 0.65 less) .....	0.45		
Length of exposed portion of superior incisors .....		0.55	0.50
Jaw, total length, ends of incisors to back of condyles .....	2.15	2.18	2.08
Jaw, total length, ends of incisors to apex of coronoid .....	1.85	1.85	1.85
Jaw, total length, ends of incisors to end of descending process .....		2.20	2.10
Length of inferior molar series .....	0.70	0.65	0.65
Length of exposed portion of inferior incisors .....	0.70	0.80	0.65
Width of the flattened plate at angle of jaw .....		0.90	0.90

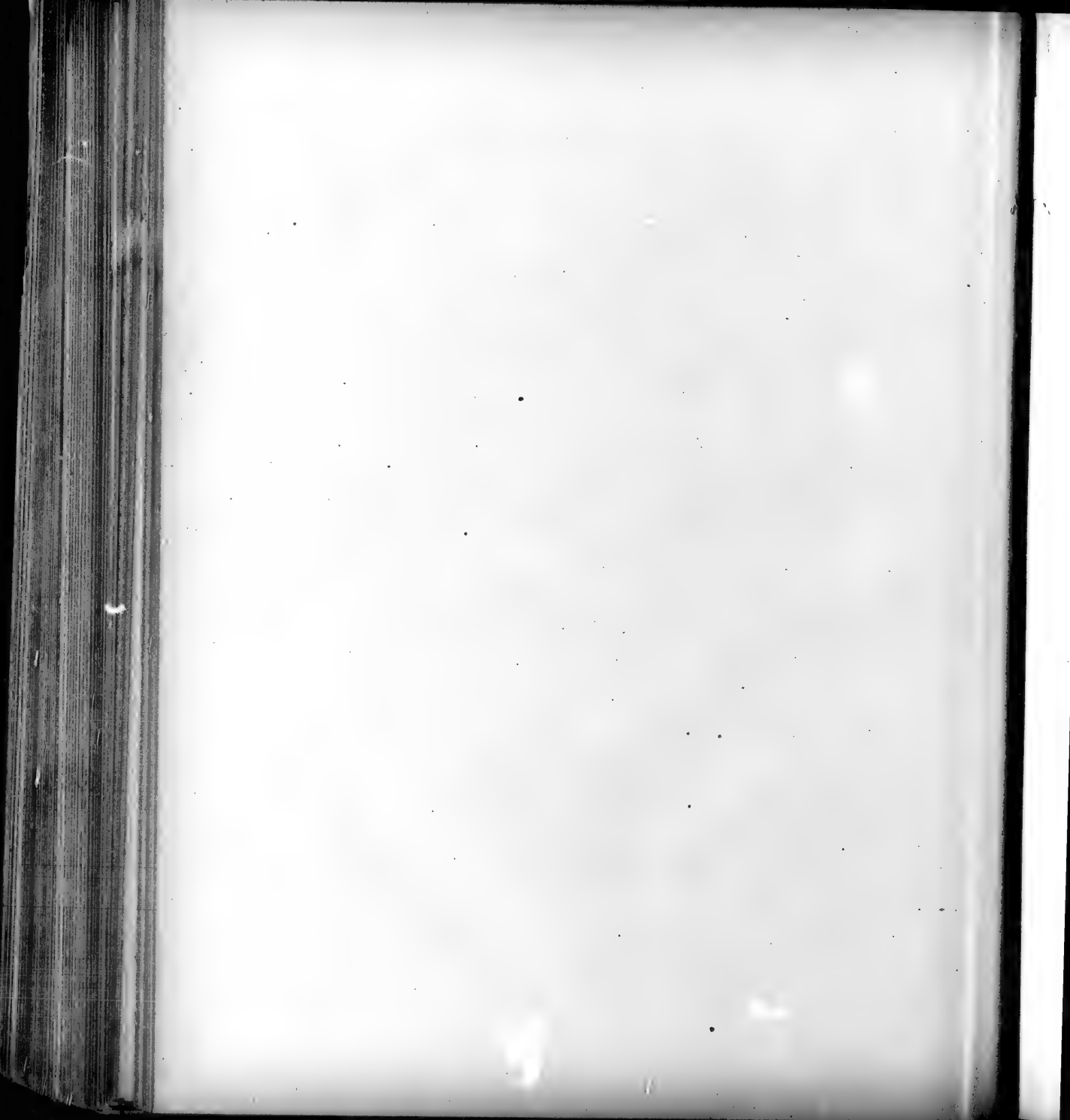
Length of skull to its greatest width, 2.90 : 2.05 :: 1 : 0.77, or width between three-fourths and four-fifths of length.

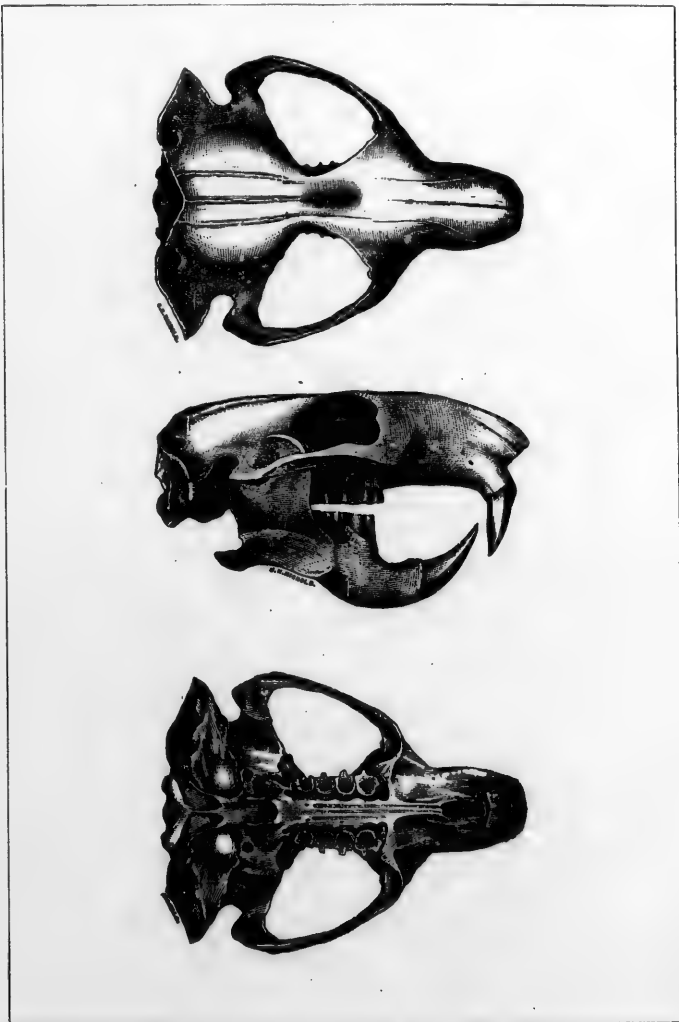
Length of skull to its depth (without jaw), 2.10 : 0.75 :: 1 : 0.36, or depth not two-fifths of length—little over one-fourth.

TABLE III.—List of specimens examined of HAPLONDON RUFUS.

Mus. No.	Locality.	Source whence received.	Collected by—	Nature of specimen and remarks.
4941	Paget's Sound ..	U. S. Expl. Expd. ..	T. R. Peale .....	♂, mounted, with detached skull accompanying.
4942	do .....	do .....	do .....	Skull belonging to No. 4941; figured, pl. vi.
3891	do .....	do .....	do .....	Skull; original of Baird's plate, if not also of Peale's
9478	Stellacoon, W. T. ..	George Suckley ..	George Suckley ..	Broken skull. [woodcut]
11393	Olympia, W. T. ..	E. C. Wingard ..	E. C. Wingard ..	♂, alcoholic, in the flesh.
11394	do .....	do .....	do .....	♂, alcoholic, in the flesh.
11397*	do .....	do .....	do .....	♂, alcoholic, in the flesh (since dissected).
11398	do .....	do .....	do .....	♂, alcoholic; skin and skull.
11399	do .....	do .....	do .....	—, alcoholic, in the flesh.

\* No. 11397 was dissected for anatomical details, the disarticulated skeleton preserved, and the skin remains in condition for mounting. Two or three stuffed skins, supposed to be still in the National Museum were not found.





Skull of HAPLEDON RUFUS. Nat. size. (3849)



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MONOGRAPHS  
OF  
NORTH AMERICAN RODENTIA.

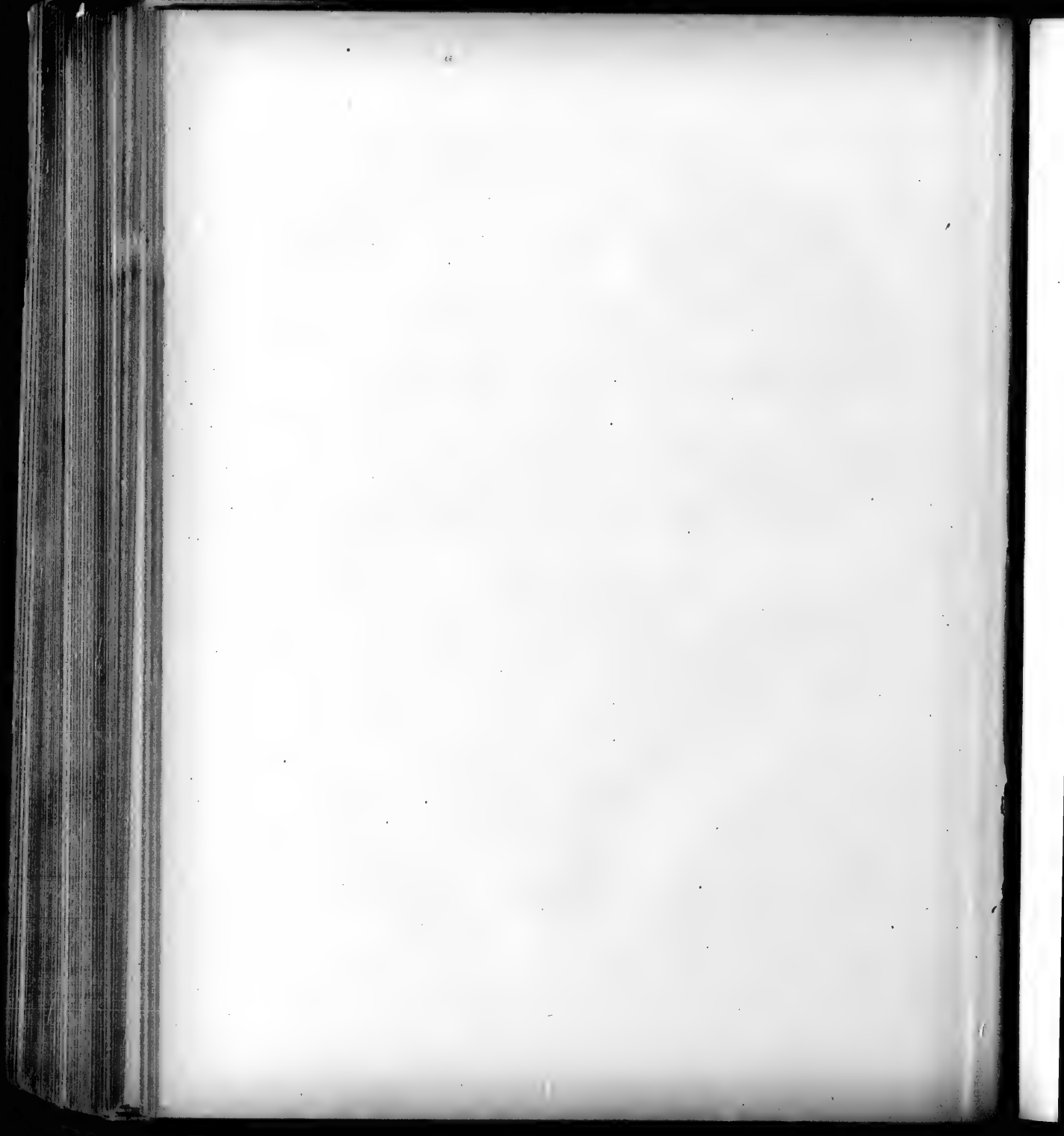
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No. X.—GEOMYIDÆ.

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By ELLIOTT COUES.

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## LETTER OF TRANSMITTAL.

OFFICE OF UNITED STATES GEOLOGICAL AND  
GEOGRAPHICAL SURVEY OF THE TERRITORIES,

*Washington, D. C., January 1, 1877.*

SIR: I transmit herewith, for publication with the series of "Monographs of North American Rodentia", a summary statement of the family *Geomyidae*, which completes my labors in this connection.

A word of explanation is here required. I finished my investigation of this family of North American Mammals, and prepared a memoir on the subject, before the present series of Monographs of the Rodents was projected. A very brief article, entitled "The Cranial and Dental Characters of *Geomyidae*", was published by you in the "Bulletin" of the Survey (2d ser. no. 2, pp. 83-90, May 11, 1875); a preliminary "Synopsis of the *Geomyidae*" appeared in the "Proceedings" of the Philadelphia Academy for 1875 (pp. 130-138); while the extended memoir itself formed "Part III.—Zoology" (pp. 215-285) of Powell's "Exploration of the Colorado of the West", and was also reissued as a separate pamphlet, with a modification of the title. Under these circumstances, it becomes inadmissible, upon considerations of economy in the expenditure of funds, to duplicate the memoir at the public expense. Yet it is considered in the last degree undesirable and inexpedient to leave the present series of Monographs incomplete. I have accordingly prepared a short article, which, omitting all details of description and criticism not necessary to the integrity of the paper, gives the gist of the subject; for the rest, I must refer you to the original memoir. I should add, however, that the present paper contains no little new matter, derived from study of specimens additional to those in hand in 1875, and serving to check the results previously reached.

I am, Sir, &c.,

ELLIOTT COUES,

*Assistant Surgeon U. S. A.,*

*Secretary of the Survey.*

Dr. F. V. HAYDEN,

*U. S. Geologist-in-charge, &c., &c.*





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## FAMILY GEOMYIDÆ.

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The group to be here treated corresponds to the *Sciurospalacoides* of Brandt, the subfamily *Geomyinae* of Baird, the family *Geomyidæ* of Gill, including only the two genera *Geomys* of Rafinesque and *Thomomys* of Maximilian. Of the former, five species have been established; of the latter, two. These animals are confined to the cold-temperate and warmer portions of continental America, from portions of British to Central America; their centre of distribution being the United States from the Mississippi Valley to the Pacific Ocean.

By all late authors, so far as I know, excepting Brandt, Gill, and myself, these animals have been united with *Dipodomys*, *Perognathus*, and *Heteromys*, in a single family, usually called *Saccomyidæ*, a leading character of which is possession, unique among Mammals, of external fur-lined pouches on the sides of the head, not directly connected with the mouth, and thus of entirely different construction and relations from the ordinary cheek-pouches of various Rodents. The classification afforded by these singular organs, which are present in two groups of animals widely different in general aspect, is undoubtedly a safe clue to natural affinities, since it is borne out by the general structural relationships of the animals; these being so close, that, after all, no great violence would be done by embracing the two groups under a single family. Yet their respective peculiarities seem sufficient to justify, if not to require, the recognition of two separate families.

The characters in question need not be here discussed nor even formally presented, as those which are shared by the two groups (being the basis of the superfamily *Saccomyoidea* of Gill), as well as those in which the two groups differ, have been presented on foregoing pages of this work, where the general bearings of the case are further discussed.

The history of the family begins at a very early (pre-Linnæan) period, though nearly everything relating to it is of much later date. The "Tucan" of Hernandez appears to have been the animal long afterward first technically

named *Ascomys mexicanus* by Lichtenstein, and his account may be the earliest literature of the subject. We have no Linnean name in this family. Bartram noted the Floridan animal in 1791; but the first "species" presented in technical nomenclature appears to be the *Mus bursarius* of Shaw (1800). The earliest generic names are *Geomys* and *Diplostoma*, imposed by Rafinesque in 1817. Various circumstances conspired not only to a vague understanding of the generic characters, but also to long delay in allocation of the genera under major heads. Richardson, who, in 1829, handled various species more effectively than his predecessors had done, merely adopted Rafinesque's genera, falling into a misunderstanding respecting the character of the pouches. So far as I am aware, after the period when "Mus" and "Cricetus" were current appellations of these animals, the first attempt to dispose of them in a formal classification was made by Waterhouse in 1839, when he treated of *Geomys*, the only genus recognized by him, as a Muroid, and as a member of his "family" *Arvicolidae*. The same year (1839), Maximilian established the second valid genus, *Thomomys*, the various generic names before proposed having been synonyms of *Geomys*. In 1848, Waterhouse made the first decided step toward a correct appreciation of the subject, bringing *Geomys* into relation with *Dipodomys*, and by proposing the group *Sacommyina* to contain them both. Gervais is said to have established or recognized at the same time a family *Pseudostomidae*, equivalent to Waterhouse's *Sacommyina*. Soon afterward, in 1855, Brandt\* established the first super-generic name *Sciurospalacoides* for these animals exclusively, relegating the Saccomyine forms elsewhere. *Geomyina* of Baird, Alston, and others, and *Geomyidae* of Gill and Coues, are other terms of exclusive pertinence to this group, which certainly belongs to the Myomorphic series of Rodents, as originally sketched by Waterhouse and more fully developed by Alston, though the question of its exact position among *Myomorpha*, aside from its obvious affinities with *Sacommyidae*, perhaps remains open. Its Murine affinities may perhaps prove to have been indicated by the name Brandt applied, but its Sciurine relationships are not so clear.

\* 1855—BRANDT (J. F.). Beiträge zur nähern Kenntniss der Säugethiere Russlands. Vierte Abtheilung. Blöcke auf die allmählichen Fortschritte in der Gruppirung der Nagetiere, mit specieller Beziehung auf die Gattung *Castor*, besonders der altweltlichen Biber. 4to. St. Petersburg, 1855. pp. 79-333, pl. 1-21 (Aus den Mémoires Math. etc. de l'Académie Imp. des Sciences, tome 5 v. 1, besonders abgedruckt.)

[*Sciurospalacoides*, p. 300. Related groups established in this paper are *Macrocalini* (= *Dipodomys*), p. 331 and p. 311, and *Perognathini* (= *Perognathus*), p. 303.]

## FAMILY GEOMYIDÆ.

## SYNONYMY.

- < *Sacomys*, WATERHOUSE, Nat. Hist. Mamm. ii, 1848, 8. (As a group of *Murida*. Included the *Sacomys*, now made a separate family. Equivalent to the superfamily *Sacomys*idea of Gill, 1872.)
- < *Pseudotomida*, GERVAYS, "Dict. Univ. d'Hist. Nat. xi, 1849". (Family. Equivalent to the *Sacomys*ina of Waterhouse.)
- < *Sacomys*, LILLJEDORF, Syst. Öfv. Gnag. Daggdj. 1866. (Family. Equivalent to *Sacomys*ina of Waterhouse.)
- = *Sciurospalacoides*, BRANDT, Bull. Sc. Acad. St. Pétersb. 1854, t. xlii, no. 7; Mélang. Biol. ii, 138; Beitr. Kennt. Südg. Russlands, 1855, 183. (Group composed of the genera *Geomys* and *Thomomys*.)
- = *Sciurospalacini*, GIEBEL, Allg. Zool. i.
- = *Geomys*, BAIRD, Mamm. N. A. 1857, 366. (Subfamily of *Sacomys*ina; the group of this name with this author being equivalent to *Sacomys*ina, Waterhouse.)
- = *Geomys*, GILL, Arrang. Fam. Mamm. 1872, 71. (Family.)
- = *Geomys*, COUES, Proc. Acad. Phila. 1875, 130. (Family.)
- = Genera *Geomys* (= *Diplostoma*, *Sacophorus*, *Pseudotoma*, *Ascomys*) and *Thomomys* of AUTHORS.—COUES, Powell's Rep. Expl. Colorado River, 1875, 217.

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- [NOTE.—Not named; described by J. Millidge.]
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- [NOTE.—*Masama*, *Diplostoma*, p. 44; *Geomys*, *Cynomys*, *Mynomes*, p. 45. *Lynx*, p. 46.]
- 1819—DESMARRETT (—). [Hamster de Virginie.] < Journ. de Physique. lxxxix, 1819, p. 159.
- 1831—MITCHELL (S. L.). Description of two mammiferous Animals of North America [*Sciurus tridactylus*, *Mus sacatus*]. < N. Y. Med. Repos. xxi, 1831, pp. 248-250.
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- 1832—MITCHELL (S. L.). Detection of mistake into which naturalists have been led in relation to the *Mus bursarius* or Pouched Rat of Canada. < Amer. Journ. Sci. iv, 1832, p. 183.
- 1835—LICHTENSTEIN (K. W. H.). Ueber äussere Backentaschen an Nagethieren. < Königl. Akad. Wiss. Berlin, Abh. der phys. Classe (1832-33), 1835.
- 1839—MAXIMILIAN (—). Ueber einige Nager mit äusseren Backentaschen aus dem westlichen Nordamerika [*Thomomys* und *Perognathus*, genn. nn.]. < Nov. Act. Acad. Cæs.-Leop. Nat.-Cur. xix, i, 1839, pp. 396-384.
- 1841—CHARLESWORTH (E.). [On Habits of *Ascomys americanus*.] < Proc. Zool. Soc. Lond. ix, 1841, p. 60.
- 1847-49—WAGNER (A.). Beiträge zur Kenntniss der Säugethiere Amerikas. < Abhandl. math.-phys. Classe, Königl. bayer. Akad. Wiss. v, 1847-49, p. 406. [Über *Ascomys canadensis*.]
- 1852—LECONTE (J. L.). An attempt at a synopsis of the genus *Geomys* [incl. *Thomomys*]. < Proc. Phila. Acad. 1852, pp. 187-.
- 1852—WOODHOUSE (S. W.). Description of a new species of Pouched Rat of the genus *Geomys* [*G. fulvus*]. < Proc. Phila. Acad. 1852, p. 201.
- 1855—BAIRD (S. F.). Characters of some new species of North American Mammalia, etc. [*Geomys clarkii*]. < Proc. Phila. Acad. 1855, 333.
- 1855—PARVIN (J. B.). On the habits of the Gopher of Illinois (*Geomys bursarius*). < Ann. Rep. Smiths. Inst. for 1854, 1855, pp. 293-294.
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- 1867—LAURENCE (J.). [On a skull of *Geomys bursarius* from the loess of the Missouri.] < Proc. Acad. Phila. 1867, p. 90.

1875—COUES (E.). Concerning "Pocket" Gophers. < American Sportsman of June 5, 1875.

[NOTE.—A popular account of Geomyidae.]

1875—COUES (E.). The cranial and dental characters of Geomyidae. < Bull. U. S. Geol. & Geogr. Surv. Terr. 2d ser. no. 2, pp. 81-90, May 11, 1875. [Reprinted, with some modification, as Addendum A of the memoir below cited.]

1875—COUES (E.). Synopsis of the Geomyidae. < Proc. Phila. Acad. 1875, pp. 130-138. [A brief abstract of the memoir next below cited.]

1875—COUES (E.). Exploration of the Colorado River of the West and its tributaries. Explored in 1869, 1870, 1871, and 1872, under the direction of the Secretary of the Smithsonian Institution. Washington: Government Printing Office. 1875. Part III.—Zoölogy. By Elliott Coues. Chapter XII.—Abstract of results of a study of the genera *Geomys* and *Thomomys*. pp. 215-285, fig. 80. (Reissued as separate pamphlet with the title "Abstract of results of a study of the genera *Geomys* and *Thomomys*, with addenda on the osteology of *Geomyidae* and on the habits of *Geomys tuza*". The reissue only differs from the original in the title.)

1875—GOODE (G. B.). Notes on the "Salamander" of Florida (*Geomys tuza*). < Powell's Rep. Colorado R. 1875, pp. 281-285.

[NOTE.—On the habits of the species; being Addendum B of the article last cited.]

For characters, especially in comparison and contrast with those of *Sacomys*, see *anted*, pp. 492, 493.

The cranial and dental\* characters are very fully presented in my paper in the Bulletin of the Survey, above cited.

The external characters are detailed at length in the descriptions of the leading species of the two genera, *Geomys bursarius* and *Thomomys talpoides*, in the zoölogical portion of Powell's Report, above cited.

The two genera are readily distinguished by the profoundly sulcate incisors, enormously developed fore claws, and rudimentary ears of *Geomys*, contrasted with the smooth incisors, moderately fossorial claws, and distinct though very small ears of *Thomomys*. There are also many cranial characters, as given beyond. The two genera offer the further curious difference, that in *Geomys* a number of species appear to have been firmly established, while the differentiation of *Thomomys* has not progressed so far. There is probably a difference in the number of mammae in the two genera; *Thomomys* usually having six pairs, while in no *Geomys* have I recognized more than three pairs. The pouches† are substantially the same in the two genera.

\* The dental formula may be rendered more precisely, as follows:—

I.  $\frac{1-1}{1-1}$ ; C.  $\frac{0-0}{0-0}$ ; P.  $\frac{1-1}{1-1}$ ; M.  $\frac{3-3}{3-3} = \frac{5-5}{5-5} = \frac{10}{10} = 20$ .

† The pouches . . . —at first supposed to be pendulous bags hanging from the mouth, then with some correction found to be not pendulous, yet believed to open into the mouth from within—are wholly external, and have no more connection with the buccal cavity than the belly-pouch of a Kangaroo or Opossum has to do with the genital organs. These sacs are simply a purse-shaped duplication of the loose skin of the side of the head and neck. The free margin of the pouch arises from the side of the upper jaw, about half-way from nose to eye, just underneath the whisker-patch, and curves loosely around the side of the head to the angle of the jaw. The general outline of the orifice is semicircular (or rather semipyriform, since the broadest part is a little); the inner border being the proper integument of the side of the head. The lining sac is ordinary integument, of rather more del-

The species of both are subject to a curious dichromatism, being sometimes found in a certain melanotic condition, in which the pelage is dark plumbago-colored, or even black, like anthracite. This appears too frequent not to be something more than the purely fortuitous melanism liable to occur as an individual peculiarity in any animal; and yet this state has not been traced to any special conditions of age, sex, or season.

### GENUS GEOMYS (*emend. ex Raf.*).

*Mus*, *sp.* SHAW, *et al.*, l. c. *infra*.

*Cricetus*, *sp.* DESM., *et al.*, l. c. *infra*.

*Geomys*, RAF., *Am. Month. Mag.* 11, 1817, 45.—DAIRD, *Mamm. N. A.* 1857, 308.—COUES, *Proc. Phila. Acad.* 1875, 130 (monographic sketch); Fowell's *Rep. Colorado R.* 1875, 290 (monograph); Bull. U. S. Geol. Surv. 2d ser. no. 11, 1876, pp. 81 seqq. (cranial characters).

*Diplostoma*, RAF., *op. et loc. cit.*

*Saccophorus*, KUHL, *Beitr.* 1820, 65.

*Pseudostoma*, SAY, *Long's Exp. R. Mts.* 1, 1823, 404.

*Acomys*, LICHT., *Abhand. Berl. Acad.* 1822-23, 1825, 20.

**GENERIC CHARACTERS.\***—Superior incisors deeply channeled along the middle, with or without a fine marginal groove. Crowns of intermediate molars truly elliptical. Root of inferior incisor but little protuberant on outside of base of condylar ramus; end of mandible thus only two-pronged, with a knob between. Zygomata widest across anteriorly, thence contracting; the width behind little, if any, greater than the intermastoid diameter of the skull. Parietals ridged along their line of union with each other. Interparietal triangular. Nasals approximately parallel-edged part way, then suddenly widening. Superficies of mastoid bone occupying nearly half the occipital surface of the skull on each side. Bullæ osseæ less inflated, quite acute anteriorly. Basi-occipital, in the middle, about as broad as the width of the bulla at the same point. A pair of broad deep pits on the palate behind, extending forward to opposite the penultimate molars. External ears usually a mere rim of integument around the auditory orifice. Fore claws enormously developed.

Containing the largest species of the genus. Geographical distribution from portions of British America to Central America, east of the Rocky Mountains, but not the Eastern and Middle States.

cate texture. It is clothed with fine fur. On the side next the head, the ordinary fur of the parts makes directly into the pouch; on the outside, the fine fur continues to the brim, where it is met by the ordinary external pelage. Between the two layers of skin rests a thin bed of muscular fibres (perhaps a modified platysma myoides), serving for such contractile movements as the receptacle may be susceptible of. But the connection between the folds of skin is so slight and loose that the pouch may, with little force, be turned completely inside out, though it does not appear that this ever occurs in life. A full-sized pouch will admit three fingers as far as the first joint."—(*Quoted from the original memoir.*)

\*The characters are drawn up with special reference to antithesis with those of *Thomomys*, beyond.



## ANALYSIS OF SPECIES.

## A. Superior incisors bisulcate; fore claws and pouches at a maximum.

- a. Incisors almost exactly bisected by the main groove, the fine marginal groove distinct; tail and feet hairy ..... BURSARIUS.  
 b. Incisors unequally divided by the main groove into larger inner and smaller outer portion, the fine marginal groove faint or obsolete; tail and feet nearly naked (South Atlantic and Gulf States) ..... TUZA.

## B. Superior incisors unisulcate; fore claws and pouches moderate.

- a. Incisors exactly bisected by the groove; fur soft; tail and feet hairy.  
 a'. Smaller; yellowish-brown, below whitish (United States) ..... CASTANOPS.  
 b'. Larger; dark reddish-brown, below plumbeous (Mexico) ..... MEXICANUS.  
 b. Incisors unequally divided by the groove into a small inner and large outer portion; pelage very hispid; tail and feet nearly naked ..... HISPIDUS.

## GEOMYS BURSARIUS, (Shaw) Rich.

## Common Pocket Gopher.

- Mus bursarius*, SHAW, Linn. Trans. v, 1800, 227, fig. 8; Gen. Zool. ii, 1801, 100, pl. 139 (the plate clearly shows the grooved incisors; the pouches are everted).—MITCHILL, Am. Journ. Sci. iv, 1822, 183 (relating to the pouches).  
*Cricetus bursarius*, DESM., "Nouv. Dict. d'Hist. Nat. xiv, —, 177; Ency. Méth. Suppl. pl. 10, f. 4"; Mamm. ii, 1822, p. 312 ("bursarius").—F. CUV., "Diet. Sc. Nat. xx, —, 257"—DESMOUL., "Diet. Class. viii, —, 37".—GRIFF., "Anim. Kingd. iii, 1827, 138, pl. —"; v, 1827, 235, no. 612.  
*Saccophorus bursarius*, KUNL, Beitrüge, 1820, 65.—FISCH., Synop. 1827, 304.  
*Pseudostoma bursarius*, SAY, Long's Exp. R. Mts. i, 1823, 406 ("bursaria").—HARLAN, Fn. Amer. 1825, 153.—LESS., Man. 1827, 259.—GODMAN, Am. Nat. Hist. ii, 1831, 90 ("bursarium").—DEKAY, N. Y. Fa. i, 1842, 92.—AUD. & BACH., Q. N. A. i, 1849, 332, pl. 44.  
*Geomys bursarius*, RICH., F. B. A. i, 1829, 203.  
*Geomys bursarius*, RICH., Sixth Ann. Rep. Brit. Assoc. Adv. Sci. for 1836, 1837, 150.—WOODH., Sitgr. Rep. Zuni and Col. R. 1853, 50 (Indian Territory).—PARVIN, Ann. Rep. Smiths. Inst. for 1854, 1855, 293 (habits).—KENN., Trans. Illinois Agric. Soc. for 1853-54, 1855, 680.—BD., M. N. A. 1857, 372, pl. 22, f. 1 a-b, and pl. 50, f. 2 a-g.—MAXIM., Arch. Natarg. 1861, —; Verz. Reise N.-Am. Süng. 1862, 147.—GERR., Cat. Bones Br. Mus. 1862, 223.—LEIDY, Proc. Acad. Nat. Sci. Phila. 1867, 97 (skull from Iowa of Missouri).—AMES, Bull. Acad. Minnesota, i, 1874, 70.—COUES, Proc. Phila. Acad. 1875, 141; Powell's Rep. Colorado R. 1875, 221 (monographic).  
*Ascomys bursarius*, EYD. & GERV., Voy. Favorite, v, 1839, 23.—SCHNEZ, Syn. ii, 1845, 132.—GIBB., Odonotog. 53, pl. 23, f. 8.  
*Geomys (Saccophorus) bursarius*, GIBB., Süng. 1855, 520.  
 ? *Mus ludovicianus*, ORD., "Guthrie's Geog. 2d Am. ed. ii, 1815, 299. (Not determinable.)"  
 ? *Diplostoma fuscus*, RAF., Am. Month. Mag. ii, 1817, 44.—DESM., Mamm. ii, 1822, 315.—LESS., Man. 1827, 261.  
 ? *Diplostoma alba*, RAF., Am. Month. Mag. ii, 1817, 44 (albino).—DESM., Mamm. ii, 1822, 315.—LESS., Man. 1827, 261.  
*Saccophorus ? albus*, FISCH., Synop. 1827, 305.  
 ? *Geomys cinereus*, RAF., Am. Month. Mag. ii, 1817, 45.  
*Mus saccatus*, MITCH., N. Y. Med. Repos. xxi (new ser. vol. vi), 1831, 249 (from Lake Superior. "The Gopher, or Pouched Rat of North America, (*Mus bursarius*.)")  
*Ascomys canadensis*, LICHT., Abh. Acad. Wiss. Berl. 1823, 13, fig.—BRANTS, Muizen, 1827, 24.—WAGN. "Suppl. Schreb. iii, 1843, 3-3; Abh. K. Kaiser. Akad. Münch. xxii, 1846, 327, fig. (skeleton)".  
*Geomys canadensis*, LEC., Proc. Acad. Nat. Sci. Phila. vi, 1852, 158.  
*Geomys drummondii*, RICH., Sixth Ann. Rep. Brit. Assoc. for 1836, 1837, 157 (Texas. A species with double-grooved incisors, apparently exactly equal to what was afterward called *breviceps* by Baird).  
*Ascomys drummondii*, WAGNER, "Suppl. Schreber".  
*Geomys oregonensis*, LEC., Proc. Acad. Nat. Sci. Phila. vi, 1852, 160 (no probability that the assigned locality is correct).  
*Geomys breviceps*, BD., Proc. Acad. Nat. Sci. Phila. 1855, 334; M. N. A. 1857, 378, pl. 52, f. 2 a-g (Texas).—GERR., Cat. Bone. Br. Mus. 1862, 223.  
 Canada Rat, SHAW, l. c.  
 Canada Pouched Rat, RICHARDSON, l. c.—AUD. & BACH., l. c.

*Hamster du Canada*, DESM., l. c.

*Pseudostoma à bourse*, LESS., l. c.

*Diplostoma brun*, *D. blanche*, DESM., LESS., II. co.

*Canadian Hamster*, GRIFF., l. c.

*Goffer*, *Taschenmaus*, SCHINZ, l. c.

*Pouched Rat*, *Sand Rat*, *Canas Rat*, *Pocket Gopher*, *Salzmander*, VULGO.

*Gaufre* or *Gaufre*, French (whence English "gopher", and German "goffer").

**DIAGNOSIS.**—Superior incisors bisulcate, with a fine sharp groove along the inner margin, and another, much larger, bisecting the remaining plane surface. Cheek-pouches ample, extending to the shoulders. Hands, including claws, longer than feet. Tail and feet hairy. Pelage soft, sleek, mole-like. Color dull reddish-brown, muddy-gray or hoary beneath, the basal portion of the fur plumbeous throughout (general color sometimes blackish-gray); feet and tail, for the most part, white or colorless. Average dimensions of adult, 7 to 8 inches, but ranging from 6.50 to 9.00 at least; tail, 2 or 3 inches; fore foot, including longest fore claw, about  $1\frac{1}{2}$  inches; hind foot, including claw, about  $1\frac{1}{4}$  inches; longest fore claw, about 0.75 inch, but very variable—from little over 0.50 to 1.25.

**HABITAT.**—Valley of the Mississippi and its tributaries in a broad sense, and somewhat beyond to the northward. "Canada." Not known to occur in the United States west of the Rocky Mountains. Specimens examined from the whole immediate valley of the Mississippi, from the State of that name to Minnesota and Dakota; also from Texas; from the Platte, Washita, and Niobrara Rivers, &c.; and from the eastern foot-hills of the Rocky Mountains of Colorado.

In the female, there are three pairs of teats—two inguinal, near together along the inside of the thighs; and another pair, pectoral, at a considerable distance. I have not been able to discover any more; and as the same number and position have been found to hold in *G. tuza*, *mexicanus*, and *hispidus*, such is probably the normal case in this genus; though in species of *Thomomys* I have distinctly recognized six pairs.

The character of the incisors demands special notice, as it is diagnostic of the species. Two grooves upon each upper incisor always persist distinctly. One of these is a sharp, fine line of impression, running along the inner margin of the tooth, about the distance of its own width from the edge. The other is a much larger, more profound, and wider sulcus, which fairly bisects the remaining surface, leaving an equal plane area on either side, exclusive of the small portion cut off by the fine marginal groove. This main groove varies a good deal in depth and width in different specimens, and, moreover, is itself sometimes sulcate; that is to say, this excavation sometimes presents,

on the outer side, a fine ridge, which marks off a secondary groove within the first. The same thing occurs in the single-grooved species—*castanops*, *mexicanus*, and *hispidus*. But this carination of the main groove is not always perceptible, and is generally so fine as to be liable to be overlooked. When most strongly marked, this supplementary groove is just like the inner marginal groove itself; and each tooth then seems to consist of two similar halves.

TABLE I.—Measurements of forty specimens, fresh and alcoholic, of *GEOMYS BURSARIUS*.

Current number.	Locality.	Sex.	From tip of nose to—					Length of—			Nature of specimen.
			Eye.	Ear.	Occiput.	Tail.	Tail to end of vertebrae.	Fore foot.	Hind foot.	Longest fore claw.	
.....	Nebraska River .....	♂	0.85	1.40	1.90	0.75	2.50	1.50	1.25	0.70	Alcoholic.
7327	Kansas .....	♂	0.95	1.65	2.00	0.50	3.00	1.50	1.35	0.70	do.
1384	Iowa .....	♂	1.12	1.70	.....	.....	2.15	1.55	1.30	0.68	do.
2330	do .....	♂	1.25	2.10	2.33	0.90	3.30	.....	1.45	0.90	Fresh.
357	Saint Louis, Mo. ....	♂	.....	.....	.....	0.80	3.00	1.00	1.35	0.55	do.
2635	do .....	♂	1.05	1.75	2.20	0.70	2.75	1.50	1.35	0.65	Alcoholic.
2636	do .....	♂	1.20	1.85	2.60	0.70	3.35	1.55	1.35	0.70	do.
2633	Illinois .....	♂	1.00	1.45	1.90	0.75	2.65	1.50	1.15	0.65	do.
1775	Vermilion River .....	♂	0.75	1.75	2.25	0.80	.....	1.75	1.25	0.75	Fresh.
2930*	Louisiana .....	♂	0.90	1.45	.....	.....	1.75	1.20	1.05	0.55	Alcoholic.
11	Fort Sisseton, Dak. ....	♂	1.17	2.08	2.42	0.90	3.08	.....	1.25	.....	Fresh.
.....	do .....	♂	1.30	2.04	2.45	0.80	.....	.....	1.05	.....	do.
3	do .....	♂	1.12	1.94	2.66	0.90	3.07	1.80	1.37	0.93	do.
4	do .....	♀	0.98	1.51	2.05	0.90	2.60	1.60	1.27	0.77	do.
5	do .....	♀	1.00	1.61	2.00	0.90	2.60	1.47	1.03	0.68	do.
6	do .....	♂	1.10	1.85	2.38	0.50	2.96	1.66	1.35	0.81	do.
7	do .....	♂	0.94	1.60	2.08	0.50	2.57	1.50	1.30	0.70	do.
8	do .....	♂	1.09	1.73	2.12	0.50	2.68	1.64	1.27	0.80	do.
9	do .....	♂	1.25	1.84	2.45	0.85	3.13	1.70	1.30	0.84	do.
10	do .....	♀	0.94	1.46	2.05	0.90	2.46	1.60	1.18	0.80	do.
11	do .....	♀	0.91	1.46	1.97	0.90	2.45	1.45	1.14	0.75	do.
12	do .....	♀	0.95	1.47	1.97	0.90	2.50	1.55	1.22	0.67	do.
13	do .....	♀	0.90	1.55	1.97	0.90	2.73	1.60	1.27	0.69	do.
14	do .....	♂	1.10	1.71	2.30	0.90	2.68	1.83	1.35	0.83	do.
15	do .....	♂	1.23	2.15	2.47	0.95	2.05	1.78	1.40	0.81	do.
16	do .....	♀	0.86	1.57	2.00	0.90	2.76	1.63	1.35	0.75	do.
17	do .....	♀	0.81	1.53	2.03	0.90	2.61	1.60	1.27	0.74	do.
18	do .....	♂	1.05	1.81	2.30	0.95	2.77	1.85	1.45	0.89	do.
19	do .....	♀	0.95	1.56	2.00	0.90	2.67	1.68	1.27	0.73	do.
20	do .....	♂	0.90	1.71	2.02	0.95	3.00	1.69	1.36	0.75	do.
21	do .....	♀	0.83	1.50	1.90	0.90	2.83	1.57	1.18	0.60	do.
22	do .....	♂	1.15	1.99	2.50	0.90	3.11	1.76	1.43	0.83	do.
23	do .....	♀	1.02	1.63	2.20	0.85	2.77	1.68	1.33	0.81	do.
24	do .....	♀	0.93	1.54	2.12	0.90	2.67	1.55	1.28	0.66	do.
25	do .....	♀	0.84	1.15	1.63	0.90	2.25	1.37	1.14	0.47	do.
26	do .....	♂	0.71	1.25	1.68	0.90	2.68	1.55	1.25	0.57	do.
27	do .....	♀	0.91	1.47	2.00	0.95	2.66	1.65	1.23	0.70	do.
28	do .....	♂	0.96	1.55	1.92	0.90	2.99	1.64	1.25	0.70	do.
29	do .....	♂	0.77	1.10	2.10	0.90	2.55	1.55	1.26	0.64	do.
30	do .....	♂	1.09	1.54	2.20	0.90	3.03	1.62	1.37	0.75	do.

\* A type of *brunneus*.

† Nos. 1-42 (orig. nos.) were measured in the flesh by the collector, Dr. C. F. McChesney, U. S. A., whose care in this matter greatly increased the value of an important collection of Mammals made by him in the locality named. "Fort Sisseton" was formerly Fort Wadsworth, Dakota.

## GEOMYS TUZA, (Ord) Coues.

## The Salamander, or Florida Pocket Gopher.

*Ground-rat*, BARTRAM, Trav. Fla., Dublin ed. 1793, 7.

*Undescribed little quadruped of Georgia*, MITCHILL, N. Y. Med. Repos. v, 1802, 80 (not technically named; article editorial, covering a description of the animal by J. Milledge, Congressman from Georgia).

*Hamster of Georgia* (MITCHILL?), "Bewick's Hist. Quad. 1st Am. ed. 1804, 525"; 2d Amer. \* (from 8th Lond.) ed. [n. d.], addenda, p. 323, wood-cut (article probably prepared by S. L. Mitchill).

*Mus tuza*, ORD, Guthrie's Geog. 2d Am. ed. ii, 1815, 292. (Based on Mitchill's animal.)

*Geomys tuza*, COUES, Proc. Phila. Acad. 1875, 132.—COUES, Powell's Rep. Colorado R. 1875, 230 (monograph).—GOODE, *ibid.* 281 (habits).

*Geomys pinetis*, RAF., Am. Month. Mag. ii, 1817, 45 (Georgia).—BRANTS, Muizen, 1827, 173.—DESM., Mamm. ii, 1822, 314 (note).—LESS., Man. 1827, 200.—RICH., Sixth Ann. Rep. Brit. Assoc. for 1836, 1837, 150.—BAIRD, M. N. A. 1857, 380, pl. 22, f. 3 a-c.—GESNER, Ann. Rep. Smiths. Inst. for 1860, 1861, 431 (habits).

*Succophorus ? pineti*, FISCHER, Syn. 1829, 305.

*Geomys pineti*, LEC., Proc. Acad. Nat. Sci. Phila. vi, 1852, 159.—ALLEN, Bull. Mus. Comp. Zool. ii, 1871, 178.

*Pseudostoma floridana*, AUD. & BACH., Q. N. A. iii, 1853, 248, pl. 150, f. 1.

*Hamster de Virginie*, DESM., Journ. de Phys. lxxxix, 1819, 150.

*Southern Pocket Rat*, AUD. & BACH., l. c.

*Geomys des pins*, DESM., LESS., l. c.

*Gopher*; *Salamander*, VULG.

**DIAGNOSIS.**—Superior incisors with a main groove dividing the tooth into two unequal portions; the outer obviously the smaller; the inner, larger moiety marked by an extremely fine marginal groove, faint, obscure, or perhaps sometimes obsolete. Tail and hind feet in adult life naked, or nearly so. Otherwise like *G. bursarius*.

**HABITAT.**—Georgia, Florida, and Alabama.

Authors speak of the upper incisors as single-grooved. But in all the numerous specimens examined, the upper incisors are double-grooved, as in *G. bursarius*, the fine second groove being perceptible as a delicate line of impression along the inner margin of the tooth. It is perfectly distinct, as a rule; and in no case have I failed to recognize clearly at least a trace of it, though in some instances it is faint, and liable to be overlooked if not closely examined. Baird says that this groove becomes obsolete in old age, implying that such is the rule; but, while not doubting that this may occur, I must consider it exceptional. *G. tuza*, therefore, has double-grooved incisors, like *G. bursarius*. The point of dental discrepancy lies elsewhere. In *bursarius*,

\* A history of Quadrupeds: Embellished with upwards of 340 engravings, chiefly copied from the original of T. Bewick by A. Anderson. — Second American, from the Eighth London Edition. — Also, an Addenda, with some animals not hitherto described. — [Vignette.] New York: T. W. Strong, 84 Nassau Street. n. d. 1 vol. 12mo. pp. i-iv, 5-335, many wood-cs.

[I have seen no earlier Amer. ed. The "Addenda", in this ed. (and probably in the earlier one), pp. 323-329, presumed to be by S. L. Mitchill, consist of Grizzly Bear, p. 323, Hamster of Georgia, p. 325, Mammoth of New York, p. 327, and Viviparous Shark of Long Island, p. 328.]

the main groove bisects what is left of the face of the tooth, after subtracting the portion cut off by the inner marginal groove; and this latter is always distinct. In *G. tuza*, the main groove divides what is left of the face of the tooth, after subtracting the portion cut off by the inner groove, into two unequal portions, whereof the exterior is the smaller; and the inner groove, always slight, may be faint, obscure, or perhaps sometimes obsolete. The only other character of *G. tuza* I can appreciate is the nakedness of the tail and feet—especially the former. The species corresponds with *G. hispidus* in this respect. In the best-marked cases, the tail is perfectly naked beyond the enlarged hairy base. The hind feet share this nakedness, but not to the same extent; the instep is nearly bare, but the toes are sparsely pilous with short colorless bristles; the back of the fore feet is in much the same condition. The depilation of the members is not always complete; younger specimens, in the plumbago state of pelage, show a hairy tail and feet as average samples of *G. bursarius*. The animal does not differ at all from *G. bursarius* in size or shape. Under these circumstances, it might be held that the present is merely a localized race of *G. bursarius*.

#### GEOMYS CASTANOPS, (Bd.) LeC.

##### The Pecos, or Chestnut Pocket Gopher.

- Pseudoeloma castanops*, BAIRD, Stansbury's Rep. Great Salt Lake, 1869, 313 (near Bent's Fort, N. Mex.).—AUD. & BACH, Q. N. A. iii, 1864, 304.  
*Geomys castanops*, LeC., Proc. Acad. Nat. Sci. Phila. 1859, 163.—BAIRD, M. N. A. 1857, 381.—BAIRD, P. R. R. Rep. x, 1859, Gunnison and Beckwith's Route, Mamm. 8, pl. 10, f. 2.—COUES, Proc. Phila. Acad. 1875, 133; Powell's Rep. Colorado R. 1875, 233 (monographic).—COUES & YARROW, Wheeler's Rep. Expl. W. 100th Merid. v, "1875" (= 1876), 111.  
*Geomys clarkii*, BAIRD, Proc. Acad. Nat. Sci. Phila. 1855, 332 (Texas).—BAIRD, M. N. A. 1857, 383, pl. 50, f. 1 a-g.—KENNERLY, P. R. R. Rep. x, 1859, Whipple's Route, Mamm. 13.—BAIRD, U. S. Mex. Bound Survey, II, pt. II, 1859, Mamm. 41.—GERR., Cat. Bones Br. Mus. 1862, 222.  
*Chestnut-faced and Pecos Gopher*, BAIRD, II, co.

**DIAGNOSIS.**—Superior incisors with a single median groove bisecting the face exactly. Fore feet shorter, or not longer, than hind feet. Feet and tail sparsely pilous. Color pale yellowish-brown above, inclining more or less to dull chestnut about the head; whitish below. Size of *G. bursarius*, or rather less. Fur soft, as usual in the genus.

**HABITAT.**—TEXAS and New Mexico. (The few specimens known to naturalists are all from this limited area.)

(Described from Baird's types of *G. castanops* and *G. "clarkii"*, and other specimens.) Distinguished by the combination of a single median groove of the incisors, pale light color, and small size. In the first-named particular,

but neither in size nor color, it agrees with *G. mexicanus*; in both these species, the single groove is central, bisecting the surface, so that, viewed from the front, there appear to be four incisors. This separates it from *G. bursarius*, with which it agrees in size, averaging about the same as *G. bursarius*, though no specimens before me are as large as the largest of the latter. Length, full grown, about 8 inches, rather less than more. Tail,  $2\frac{1}{2}$  to 3 inches. A notable peculiarity of form, in comparison with *G. bursarius*, lies in the relative proportions of the fore and hind feet, which are much as in *GG. mexicanus* and *hispidus*; the palm, claws included, being shorter, or no longer, than the sole and claws; the latter measuring about  $1\frac{1}{4}$  inches, the former only about  $1\frac{1}{4}$  inches. External ears obsolete. Hairiness of tail and hind feet much as in average *G. bursarius* or *G. mexicanus*—they are thinly clothed indeed, but more hairy than in *G. tuza* or *G. hispidus*.

Coloration dull, pale chestnut, or almost fawn-color, shaded with the plumbeous basal portions of the fur. This tawny or fulvous tone is highly characteristic in comparison with the deeper and warmer chocolate or mahogany or muddy-brown of *G. bursarius* and *G. mexicanus*. On the under parts, though the plumbeous basal portion of the fur shows considerably, the general tint is whitish—quite white in comparison with the muddy-gray of the same parts of *G. bursarius*. Whiskers mostly colorless, or fine and numerous, the longest about equaling the head. Claws pale horn-color; palms and soles variously discolored. Incisors orange.

Notwithstanding the difference in size and color, the affinities of this species are decidedly with *G. mexicanus* rather than with *G. bursarius*.

#### GEOMYS MEXICANUS, (Licht.) Rich.

##### The Tucan, or Mexican Pocket Gopher.

- Geomys mexicanus*, LICHT., Abhand. K. Acad. Wiss. Berl. 1827, 113.—BRANTS, Muizen, 1827, 27.—WAGN., Suppl. Schreb. iii, 1843, 384; iv, pl. 206 A.—CHARLESW., P. Z. S. ix, 1841, 60 (habits).—SCHINZ, Synop. ii, 1846, 133.
- Saccophorus mexicanus*, FISCH., Synop. 1829, 305.—EYD. & GERV., "Géérin's Mag. vi, 1836, 23, pl. 91, f. 5, 6; Voy. Favorite, v, 1839, 23, pl. 8, f. 5, 6".—GRAY, List Mamm. Br. Mus. 1843, 150.—GERR. Cat. Bones Br. Mus. 1862, 223.
- Geomys mexicanus*, RICH., Sixth Ann. Rep. Brit. Assoc. Adv. Sci. for 1836, 1837, 150.—LEC., Proc. Acad. Nat. Sci. Phila. 1852, 160.—BAIRD, M. N. A. 1867, 387.—COUES, Proc. Phila. Acad. 1875, 133; Powell's Rep. Colorado R. 1875, 236 (monograph).
- Pseudostoma (Geomys) mexicana*, AUD. & BACH., Q. N. A. iii, 1854, 309.
- Geomys (Saccophorus) mexicana*, GIBB., Säng. 1855, 529.
- TUCAN of HERNANDEZ.—TUZA or TUSA, MEXICAN.—TUGAN apud GERR., l. c.
- Mexicanische Taschenmaus, GERMAN.

DIAGNOSIS.—Superior incisors bisected by a single median furrow (as in

*G. castanops*, which is very different in size and color). Coloration and general appearance of *G. bursarius* (which has two distinct grooves on the upper incisors). Fur soft, sleek (as in other species of the genus, excepting *G. hispidus*, in which it is extremely coarse and harsh). Averaging much larger than any United States species (nearly equaling *G. hispidus*), with proportionally smaller pouches and hands, and weaker claws (these parts being as in *G. hispidus*). Tail and feet clothed (as usual in the genus), not naked as in *G. hispidus* and *G. tuza*. Length, 10-11 inches; tail, about 3; sole, perhaps 1.50; hand, rather less. Mammaræ, three pairs, as in other species.

HABITAT.—Mexico. (Limits of distribution unknown. Not known to occur north of Mexico.)

Shares with *G. castanops* the single median\* furrow of the upper incisors, but is much larger and different in color. The well-prepared specimen† here described is only equalled in a large series of *G. bursarius* by a single much over-stuffed example. The pouches, as well as can be judged from the skin, are smaller proportionally than those of the United States species; in this respect being like those of *G. hispidus*. These two Mexican species further agree in the relative smallness of the hands and less enormous development of the claws; the fore member being shorter or, at most, not longer than the hinder one. The orifice of the external ear presents, in the dried state, a mere rim, around which no flap can be fairly recognized. In color, the specimen is not decidedly different from *bursarius*, though there is a purity of the chestnut-brown which contrasts with the muddy-brown (in some cases almost a glaucous shade or "bloom") commonly seen in *bursarius*. The fur is deep plumbeous basally, pointed with the warm brown on the upper parts, and only partially hidden below by muddy-gray and hoary ends of the hairs. Auricular region darkened. Hind feet and tail mostly whitish. There is some whitishness about the lower jaw, and a small white abdominal and anal patch; these last being of indeterminate character. The plumbago or "anthracite" variation of pelage occurs in this as in other species of this family.

\* *G. hispidus* has been described as having a single median furrow; the emphasis here, however, is upon "single", in antithesis to the double furrow of *G. bursarius*, without reference to exact position. *G. tuza* is said to have a "single" furrow; but the proper implication is merely obsolescence of the fine inner second furrow usually seen. In *G. merriami*, as in *G. castanops*, the furrow is truly single and median; in *G. hispidus*, single and internal; in *G. tuza*, apparently single and external.

† No. 3532, Mus. Smiths. Inst., Xalapa, Mexico, *De Oca*.



## GEOMYS HISPIDUS, LeC.

## The Quachil, or Central American Pocket Gopher.

*Saccophorus quachil*, GRAY, P. Z. S. xi, 1843, 79, ex Coban, Vera Paz, descr. nulla!—GERR., Cat. Bones Br. Mus. 1862, 223.

*Geomys hispidus*, L&C., Proc. Acad. Nat. Sci. Phila. 1852, 158 (descr. orig.).—BAIRD, M. N. A. 1857, 326, pl. 28, f. 4 a-d.—COUES, Proc. Phila. Acad. 1875, 133.—COUES, Powell's Rep. Colorado R. 1875, 220 (monograph).

*Paradosoma (Geomys) hispidum*, AUD. & TACH., Q. N. A. iii, 1854, 306.

*Geomys heterodus*, PETERS, Monatsb. Akad. Wiss. Berlin, 1864, 177 (Costa Rica).

*Geomys "hirsutus"*, COUES, Proc. Phila. Acad. 1875, 131 (by slip of pen for *hispidus*).

**DIAGNOSIS.**—Superior incisors with a single strong deep furrow, lying wholly in the inner half of the tooth.† Tail and hind feet naked, or nearly so; fore feet sparsely hirsute. Fore feet, including claws, decidedly shorter than the hind feet. Pouches moderate, scarcely or not reaching beyond the head. Pelage stiff, hispid, and almost lustreless. Color uniform dull chocolate-brown, merely paler, grayer, or smoky-brown below; all the hairs one-colored from base to tip. Of largest size; nearly or about a foot long; girth some 9 inches; tail short, about 3 inches or rather less from extreme base, its naked part only about 2 inches; sole,  $1\frac{3}{8}$ – $1\frac{1}{2}$ ; palm, including longest claw, less than this. ♀ with only 3 pairs of mammae determined, 2 pairs inguinal, 1 pair pectoral.

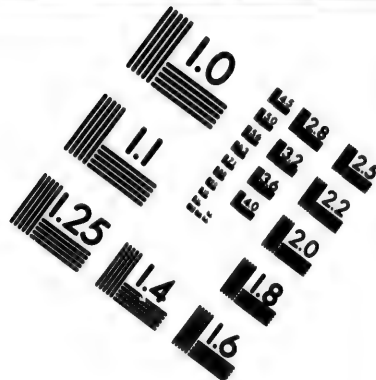
**HABITAT.**—Mexico and Central America. (Xalapa, Mexico (*De Oca*); Necostla, Mexico (*Sumichrast*); Costa Rica (*Zeledon* and *Carmiol*); Guatemala City (*Van Patten*))

The most notable external feature is the nakedness of the tail and feet. The tail, in extreme cases, is absolutely bare; the hind feet, from the tarso-metatarsal joint outward, are nearly bare, though a few bristly hairs may be observed, especially on the toes. The hands share the same nakedness, but in less degree. Specimens vary in these respects; in some, delicate bristles

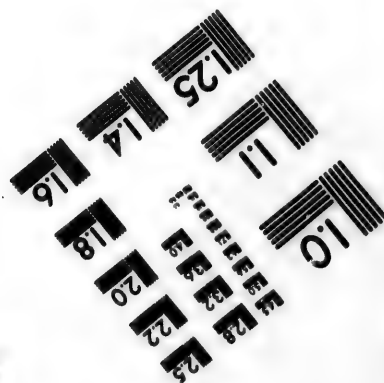
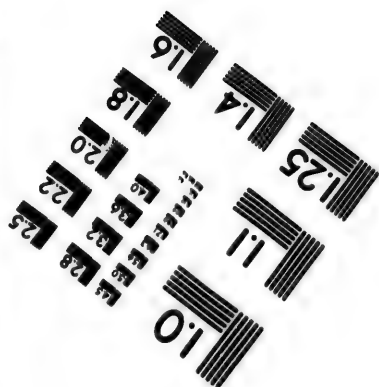
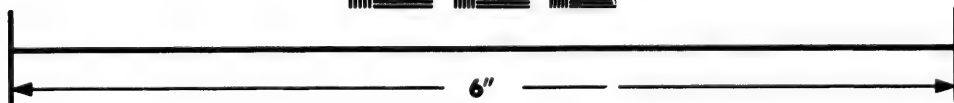
\* Special paper: „Ueber neue Arten der Sägethiergattungen *Geomys*, *Haplodon* und *Dasypros*." < Loc. cit. pp. 177–181.

† In the earlier notices by LeConte and Baird, the character of the upper incisors was not fully indicated, owing to defect of the specimens. These teeth are unisinate, as in *mexicanus*, but the position of the groove constitutes a perfect specific character. In *mexicanus*, a single profound groove bisects the tooth; in *hispidus*, a similar single groove lies on the inner half of the tooth. In some specimens, indeed, where the groove is widest, it may encroach slightly upon the median line; but it usually lies altogether to one side, the outer plane surface of the tooth being alone as wide as the groove plus the inner plane surface. This character is unique among the species described in this paper; and it is the basis of *G. heterodus*, as I find upon examining Prof. Peters's paper, which I was not able to consult in the preparation of my previous articles upon this family. Prof. Peters alludes to the original *S. quachil* of Gray, but seems to have overlooked Dr. LeConte's description of *G. hispidus*.





A resolution test chart featuring several groups of horizontal and vertical lines of varying thicknesses. Each group is accompanied by a numerical value indicating the resolution. The values include 1.0, 1.1, 1.25, 1.4, 1.6, 1.8, 2.0, 2.2, 2.5, 2.8, 3.2, 3.6, 4.0, 4.5, 5.0, 5.6, 6.3, 7.1, 8.0, 9.0, 10, 11.2, 12.5, 14, 16, 18, 20, 22.5, 25, 28, 32, 36, 40, 45, 50, 56, 63, 71, 80, 90, 100, 112, 125, 140, 160, 180, 200, 225, 250, 280, 320, 360, 400, 450, 500, 560, 630, 710, 800, 900, 1000, 1120, 1250, 1400, 1600, 1800, 2000, 2250, 2500, 2800, 3200, 3600, 4000, 4500, 5000, 5600, 6300, 7100, 8000, 9000, 10000.



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are scattered over the tail, and more evident ones clothe the instep; but the parts always present a peculiar skinny appearance. Tail less than one-fourth as long as the head and body; hands not as long as the feet; smaller and weaker than in the *bursarius* group; cheek-pouches are not so highly developed. As well as can be judged from prepared skins, the sacs do not reach to the shoulder; their capacity, in an individual nearly a foot long, seems no greater than that of specimens of *G. bursarius* not more than half as bulky. The external meatus of the ear has a small flap. The hispid pelage is a remarkable feature, being coarse and harsh, almost entirely lustreless, longer than usual, and interspersed with still longer and almost bristly hairs; and the color is uniform to the roots of the hairs. It is characteristic of all the soft-haired species of *Geomys* to have plumbeous-colored fur at base, pointed with the particular brown, fulvous, or other shade which determines the appearance to the eye. In *G. hispidus*, the hairs are unicolor from base to tip; dark mahogany-brown, or rather chocolate, a little lighter or darker according to age or season, or fortuitously, but uniform over all the upper parts and sides. Underneath, the color is paler, like *café au lait*; sometimes quite smoky-gray or muddy-brown. The under parts frequently show indeterminate patches of white. It is probable that plumbago-colored individuals occur, but I have seen none such. The naked parts appear to have been reddish or flesh-colored; claws horn-color; incisors faced with red.

*Note on a skull.*

In preparing the original memoir, I regretted that I had no skull of either of the Mexican species to describe. Since then I have found a defective specimen in the collection of the National Museum, marked "*hispidus*—Mex." It is much larger than any United States specimen I have seen, measuring in total length (from occipital crest to incisive alveoli) 2.70 inches, with a width of 1.85 across the widest part of the zygomatic arches. (A good-sized specimen of *G. bursarius* measures in the same dimensions  $2.25 \times 1.50$ .) Greatest depth of skull, without jaw, 1.18 (opposite premolars; the corresponding dimension of *G. bursarius* is only 0.70). Width across occiput, 1.65. Length of lower jaw (condyle to incisive alveolus), 1.80 (in *G. bursarius*, 1.45); greatest divergence of rami of the jaw (at the exflected angles), 1.80. The enormous under incisors protrude more than an inch—1.25; the upper incisors are exerted for 0.65. The zygomatic width is increased by a well-marked

flange-like expansion of the malar anteriorly, where, at the point of greatest width, the bone is 0.35 in breadth; the process extends obliquely downward and outward, with rounded contour. Nothing equalling this special expansion of the malar is seen in any of the United States species, skulls of which have been examined, though the bone is usually thicker in the corresponding portion of its course than elsewhere; and, in *G. castanops* particularly, is somewhat laminar at the corresponding point. The skull as a whole is "rugged", with the several ridges and angles highly developed; the jaw is specially massive. There seems to be a peculiarity in the "set" of the lower incisors, apparently determined by their great protrusion. In *G. bursarius*, holding the jaw horizontal, i. e. with the crowns of the molars on a level, the incisor-tips still incline strongly obliquely forward. In the present species, when the jaw is similarly viewed, the ends of the incisors are vertical, so great is their curvature. Various peculiarities of the skull might be noted, but they may be considered covered by the statement of its great massiveness, roughness, and angularity. The pattern of the molar crowns seems to be much the same.

#### GENUS THOMOMYS, Maxim.

*Diplostoma*, RICHARDS, Fu. Bor.-Am. 1, 1889, 206 (nec Raf.).

*Oryzomys*, pt. EYD. & GRAY, Mag. Zool. vi, 1836, 33.

*Thomomys*, MAXIM., N. Act. Acad. Cæs. Leop. xix, 1839, 383.—BAIRD, M. N. A. 1857, 388.—COUES, Proc. Phila. Acad. 1875, 134 (monographic sketch).—COUES, Powell's Rep. Colorado R. 1875, 243 (monograph).—COUES, Bull. U. S. Geol. Surv. 2d ser. no. ii, 1875, pp. 81 seqq. (cranial characters).

*Thomomys*, BRANDT, Belt. Kennt. Südg. Russl. 1855, 187.

(In addition to the foregoing, all the synonyms of *Geomys*, *g. v.*, have been applied to this genus.)

**GENERIC CHAR.**—Superior incisors without median sulcus, but with a fine marginal groove (sometimes obsolete). Crowns of intermediate molars acute-edged exteriorly. Root of inferior incisors causing a protuberance on outside of base of condylar ramus nearly as high as condyle itself; end of mandible thus singularly three-pronged. Zygomata regularly convex outward, with a sweeping curve; their breadth across posteriorly decidedly greater than the intermastoid diameter of the skull. Parietals ridged externally near the squamo-parietal suture. Interparietal rather pentagonal. Nasals widening uniformly from behind forward. Surfaces of mastoid bone restricted to less than a fourth of the occipital surface on each side. Bullæ osseæ more inflated, quite obtuse anteriorly. Basi-occipital, in the middle, much narrower than the bulla at the same point. A pair of slight pits on the palate behind, not extending beyond the ultimate molars. External

ears, though very small, provided with a distinct auricle. Fore claws moderately developed. Containing the smaller species of the family. Distributed from British America to Mexico, from the valley of the Mississippi to the Pacific.

Readily distinguished from *Geomys* by the characters given in the foregoing paragraph, the expressions used being antithetical to those of the diagnosis of *Geomys* on p. 611.

The numerous species of this genus described by Richardson, LeConte, Baird, and others are reducible to one, with three geographical races. The following schedule exhibits the relations of the several forms as treated by the two latest systematic writers on this genus:—

BAIRD, 1857.		COUES, 1875.	
1. <i>Thomomys bulbivorus</i> ..	Pacific coast region .....	{ BULBIVORUS .....	As well-marked geographical races of one species not completely differentiated into three.
2. <i>Thomomys laticeps</i> .....			
3. <i>Thomomys douglasii</i> .....			
4. <i>Thomomys borealis</i> .....	Northern Interior .....	{ TALPOIDES .....	
5. <i>Thomomys rufescens</i> .....			
6. <i>Thomomys</i> "talpoides" .....			
7. <i>Thomomys umbrinus</i> .....	Southern Interior and Lower California .....	{ UMBRINUS .....	
8. <i>Thomomys fuscus</i> .....			

For a full discussion of the subject, reference may be made to the original memoir. The following is an epitome of the results attained in the discrimination of the three forms:—

**Size.**—The Northern Interior form and the Pacific Coast form are of the same size; the Southern Interior form averages an inch or two less in total length than the other; but large specimens of the latter, and small examples of the two former, overlap each other in stature.

**Form.**—The Northern Interior race and the Northern styles of the Pacific Coast race have larger fore claws than the Southern style of the Pacific Coast race or than the Southern Interior race. The difference is sufficient to make the whole hand of the former about equal to the foot, while, in the latter, the hand is usually shorter than the foot. But this is only true as a rule; there are many exceptions. In all three of the forms, the tail, measured from its true base, ranges from one-third to one-half the total length of head and-body, though only rarely reaching either of these extremes. Nothing can be predicated on this score.

**Color.**—The Northern Interior race is a rat-colored animal, hoary-gray underneath, with white tail and feet, much white about the mouth, and no

sooty-blackish there. The Pacific Coast race is a rich dark-brown animal, muddy-bellied, with dusky tail and feet, wholly or in part, and sooty about the mouth. The Southern Interior race is usually a rich tawny or fulvous animal, with partly dark tail or feet, or both, sooty mouth-parts, and white pouches. This race is particularly variable in color; and, in every respect of color, all the races show much variation, and, moreover, intergrade completely.

The various forms under which the genus *Thomomys* is exhibited may be discriminated by the following characters:—

## ANALYSIS OF SPECIES AND VARIETIES.

- |  |   |
|--|---|
| <p>A. Large. Hind foot an inch or more long. Tail at least one-third as long as head and body. Above brown, reddish, &amp;c. Below gray, brown, reddish, &amp;c. (not white). Ears in a blackish area well developed.....</p> <p>a. Six to eight inches long; fore claws highly developed (0.45 to 0.55 long), making the hand about as long as the foot. Color of the house-rat, with white tail and feet, and usually white about the mouth and throat; no contrasts of dark color about the mouth. (Northern Interior).....</p> <p>b. Seven to nine inches long; fore claws less developed, usually under 0.50, leaving the hand shorter than the foot. Reddish-brown, the belly muddy-brownish, feet and tail usually not entirely white; mouth-parts dark, contrasting with white of the pouch-lining. (Pacific Coast).....</p> <p>c. Smaller on an average; usually six to seven inches long. Fore claws about 0.40 or less, leaving the hand decidedly shorter than the foot. Rich fulvous, or even fawn-color, the same below but paler, variously obscured on the back with dusky; tail and feet usually dark; face and mouth-parts sooty-blackish, sharply contrasting with white pouch-lining. (Southern Interior and Lower California).....</p> <p>B. Small; decidedly less than six inches long. Hind foot about 0.75; fore foot still less. Tail scarcely one-fourth as long as the head and body. Above, pallid yellowish-gray, with a shade of light brown; below, entirely white; feet and tail white. Ears minute, not in a blackish area. Nose blackish. (Bridger's Pass, Rocky Mountains).....</p> | <p>1. TALPOIDES.</p> <p>a. <i>talpoides</i>.</p> <p>b. <i>bulbivorus</i>.</p> <p>c. <i>umbrinus</i>.</p> <p>2. CLUSIUS.</p> |
|--|---|

## THOMOMYS TALPOIDES, (Rich.) Baird.\*

## Northern Pocket Gopher

- Cricetus talpoides*, RICH., Zool. Journ. III, No. 19, Jan.-Apr. 1839, 518. (Plumbeo-colored.)
- Geomys talpoides*, RICH., F. B. A. 1, 1839, 904; Rep. Brit. Assoc. for 1836, vi, 1837, 150, 156. (Same as the preceding, but "Florida" assigned wrongly as a locality.)—DEKAY, N. Y. Fa. 1842, 93. (Compiled from Richardson.)—SCHNEIDER, Synop. Mamm. II, 1845, 137. (Compiled from Richardson.)—LECONTE, Proc. Acad. Nat. Sci. Phila. vi, 1862, 168. (Compiled from Richardson.)
- Saccophorus talpoides*, FISCHE., Synop. Mamm. 1839, 598 (marked "395"). (Compiled from Richardson.)
- Atomys talpoides*, WAGN., Suppl. Schreb. III, 1843, 390. (Compiled from Richardson.)
- Pseudostomus talpoides*, AUD. & BACH., Q. N. A. III, 1853, 43, pl. 110. (Compiled from Richardson; figure from the type-specimen.)
- Geomys (Thomomys) talpoides*, GIBBS, Slog. 1855, 530. (Compiled from Richardson.)
- Thomomys talpoides*, BAIRD, M. N. A. 1857, 403. (Compiled from Richardson.)—COUES, Proc. Phila. Acad. 1875, 135.—COUES, Powell's Rep. Colorado R. 1875, 350 (monographic; Richardson's species identified, described, and discussed).

\* Special paper: "Short characters of a few Quadrupeds procured on Capt. Franklin's late Expedition." < The Zoological Journal, III, No. 12, Jan.-Apr. 1839, pp. 516-600.

- Geomys borealis*, RICH., Rep. Brit. Assoc. for 1836, vi, 1837, 150, described on p. 157. ("Saskatchewan.")—BACHM., Journ. Acad. Nat. Sci. Phila. 1839, 103. (Originally described from Richardson's type, "Columbia R.," marked "*Pseudotoma borealis*, Rich.")—DEKAY, N. Y. Fn. 1842, 92. (Compiled from Bachman.)—SCHINZ, Synop. Mamm. N. 1845, 136. (Compiled from Bachman.)
- Ascomys borealis*, WAGN., Suppl. Schreb. iii, 1843, 391. (Compiled.)
- Saccophorus borealis*, GRAY, List Br. Mna. 1843, 149 ("Canada?") mere mention, with some wrong synonyms.)—MURIE, P. Z. S. 1870, 80 (as host of *Estrus*).
- Pseudotoma borealis*, "RICH. MSS."—AUD. & BACH., Q. N. A. iii, 1853, 108, pl. 142. (Description and figure apparently from the original specimens.)
- Thomomys borealis*, BAIRD, Mamm. N. A. 1857, 396, pl. 22, figs. 2a-c. (Account from types of "*borealis*" and "*townsendii*", in Mus. Phila. Acad., with which a Californian specimen is considered probably identical.)—NEWM., P. R. R. Rep. vi, 1857, 59 (rests on the Californian specimen just mentioned).
- Geomys townsendii*, "RICH. MSS."—BACHM., Journ. Acad. Nat. Sci. Phila. 1839, 105. ("Columbia R." Described as distinct from "*borealis*", with much hesitation, entirely in deference to Richardson.)—RICH., Zool. Voy. Blomm., 1832, p. 19'.—DEKAY, N. Y. Fn. 1842, 92. (Compiled from Bachman.)—SCHINZ, Synop. Mamm. ii, 1845, 137. (Compiled.)
- Ascomys townsendii*, WAGN., Suppl. Schreb. iii, 1843, 391.
- Geomys unisulcatus*, GRAY, "Br. Mna."—GRAY, l. c.
- Thomomys rufescens*, MAXIM., Nov. Act. Acad. Cæs.-Leop. xix, pt. 1, 1839, 383; Arch. f. Naturg. 1841, pt. ii, 42; *ibid.* 1861, —; Verz. Säug. N.-Am. Reise, 1862, 149, pl. 4, f. 5 (penis-bone). (In the last quotation, the generic name is spelled "*Tomomys*".) (Missouri region.)—SCHINZ, Synop. Mamm. ii, 1845, 134 (exclusive of the synonym *Orgelomys botas*, Eyd. & Gerv.). (Compiled from Maximilian; California erroneously assigned as the locality.)—BAIRD, Proc. Acad. Nat. Sci. Phila. vii, 1855, 335; M. N. A. 1857, 397. (Redescription of specimens from "Nebraska", l. c., Dakota; Forts Pierre, Randall, and Union.)—BAIRD, P. R. R. Rep. x, 1850, Gunnison's and Beckwith's Routes, Mamm. p. 8, pl. 10, f. 1 (the same).—STEVENSON, U. S. Geol. Surv. Terr. for 1870, 1871, 469 (Wyoming).—AMES, Bull. Minn. Acad. i, 1874, 70 (catalogued upon presumption of its occurrence in Minnesota).—ALLEN, Proc. Acad. Nat. Sci. Phila. xii, 1874, 43 (Yellowstone River); Bull. Eas. Inst. vi, 1874, 56, 61, 65 (rather supposed than known to be this species).
- Geomys rufescens*, LECONTE, Proc. Acad. Nat. Sci. Phila. vi, 1853, 161. (Redescribed from types of "*borealis*" and "*townsendii*", in Philadelphia Academy, marked "Columbia River".)
- Ascomys rufescens*, WAGN., Suppl. Schreb. iii, 1843, 387.
- Geomys (Thomomys) rufescens*, GIERKE, Säug. 1855, 530.
- Thomomys "fulvus"*, MERR., Ann. Rep. U. S. Geol. Surv. Terr. for 1872, 1873, 665. (Nae Woodh.)

**DIAGNOSIS.**—Coloration almost exactly that of the house-rat (*Mus decumanus*)—sometimes assuming a more reddish phase, occasionally blackish-plumbeous; tail and feet white, and much of the chin, throat, and breast white in irregular patches, where the fur is white to the base. No sooty-blackish about the mouth-parts; no obvious distinction in color between the pouch and its surroundings; no strongly-pronounced reddish-brown on the under parts; general tone of coloration never decidedly tawny. Ears set in a small blackish area. Length, 6 to 8 inches; tail, 3 inches or less, decidedly less than half the length of head and body; fore and hind feet (claws included) approximately equal to each other, 1.10 to 1.25; longest fore claw little less than the length of the rest of the hand, about 0.50. Mammas, 6 pairs—2 pairs inguinal, pectoral, and axillary, respectively. In some specimens, however, one or two pairs apparently fail to develop, generally the axillary ones.

**HABITAT.**—Supposed to occur in the Interior of North America, from "Hudson's Bay" to the "Columbia River", and to occupy about the northern half of the United States west of the Mississippi, exclusive of the Pacific Coast region; being replaced, to the west, by *T. bulbivorus*, and, to the south, by *T. umbrinus*. (Undoubted specimens seen from Selkirk Settlement, British America; from Minnesota westward through Dakota and Montana to the Rocky Mountains; and from Idaho, Wyoming, Utah, and Nevada.)

TABLE II.—Measurements of eight fresh specimens of THOMOMYS TALPOIDES.

Carnal number.	Locality.	Collector.	Sex.	From tip of nose to—					Length of—		Nature of specimen.	
				Eye.	Ear.	Orbit.	Tail.	Tail to end of ear taken.	Fore foot.	Hind foot.		
11515	Souris River, Dakota.	Dr. E. Cress, U. S. A.	♂	1.00	1.40	1.75	7.00	2.50	1.30	1.35	0.55	Fresh.
11517	Pembina, Dakota.	do	♀	0.75	1.40	1.00	6.85	0.75	1.15	1.35	0.55	do.
11519	do	do	♂	0.50	1.00	1.70	7.50	2.50	1.50	1.50	0.50	do.
11520	do	do	♂	0.50	1.00	1.00	7.85	0.75	1.35	1.50	0.45	do.
11522	do	do	♂	0.50	1.00	1.00	7.00	2.50	1.55	1.50	0.55	do.
1	Fort Mission, Dakota.	Dr. C. E. McChesney, U. S. A.	♀	0.75	1.25	1.00	6.50	1.00	1.00	1.00	0.50	do.
2	do	do	♂	0.77	1.20	1.07	7.00	1.07	1.17	1.17	0.47	do.
54	do	do	♂	0.84	1.50	1.01	7.50	2.10	1.15	1.15	0.49	do.

**NOTE.**—The first five foregoing specimens, all adult, taken the same season (June to September, 1873), were carefully measured in the flesh by myself. Other specimens, from the same region, not measured in the flesh, carry the limits of total length from about 6 to about 8 inches, with a corresponding range of variation in other parts. The tail is taken from its true base—it appears about half an inch shorter in the dried state. The weight of these specimens ranges from 6 to 7 ounces. The girth of the chest is about 5 inches; of the belly, 4.50. No. 11517, ♀, has 12 teats—8 pairs axillary, 2 pairs pectoral, 2 pairs inguinal. When fully distended, in the fresh state, the width across the cheek-pouches is the greatest diameter of the body. Nos. 1, 2, 54 (orig. nos.), all adult, were measured in the flesh by the collector, Dr. C. E. McChesney, U. S. A. The measurements of tail seem to have been taken by him from its apparent base.

The most northern specimen I have seen is from the Assiniboine River; the species is supposed to range from Hudson's Bay to the Rocky Mountains in British America (northern limit unknown). In the United States, I have specimens from Minnesota, Dakota, Montana, Idaho, Nebraska, Wyoming, Nevada, and Utah. The southern limit is inferred to be somewhere along the middle of the United States. Its range may not inosculate with that of *T. umbrinus*; at any rate, I have seen no intermediate specimens from anywhere in the Interior, the approach to *umbrinus* seeming to be made in the Pacific province, through *bulbivorus*. True *talpoides* exists fairly westward of the main chains of the Rocky Mountains; but no *Thomomys* of this style is known from immediate Pacific slopes. It meets and inosculates with the Northern style of *bulbivorus* ("douglasi") in the Columbia River region.

This animal is elaborately described, and its synonymy fully discussed in the original memoir.



## THOMOMYS TALPOIDES BULBIVORUS, (Rich.) Coues.

## Pacific Pocket Gopher.

- Diplostoma? bulbivorus*, RICH., F. B. A. i, 1839, 306, pl. 18 B (lettered *douglasi* by mistake).—RICH., Zool. Voy. Blossom, 1839, pp. 9 and 13\*.
- Geomys bulbivorus*, RICH., Ann. Rep. Brit. Assoc. for 1836, vi, 1837, 150.—DEKAY, N. Y. Fa. 1849, 92. (Compiled from Richardson.)—SCHNEZ, Syn. Mamm. ii, 1945, 135. (Compiled; quotes *D. "bulbiferum"*; gives wrong locality.)—LECONTE, Proc. Acad. Nat. Sci. Phila. 1853, 162. (Compiled from Richardson.)
- Ascomys bulbivorus*, WAGN., Suppl. Schreb. iii, 1843, 387. (Compiled.)
- Pseudostoma bulbivorum*, AUD. & BACH., Q. N. A. iii, 1854, 337. (Compiled from Richardson.)
- Geomys (Thomomys) bulbivorus*, GIER., Slog. 1855, 530. (Compiled from Richardson.)
- Thomomys bulbivorus*, BRANDT, Beitr. Kennt. Slog. Russl. 1855, 182, pl. 5, f. 1-9 (skull and teeth).
- Thomomys bulbivorus*, BAIRD, M. N. A. 1857, 399, pl. 50, f. 3 a-g, and pl. 52, f. 1 a-g. (Identifies the common Californian animal with this species of Richardson's, and minutely describes it.)—BAIRD, P. R. R. Rep. x, 1859, Williamson's Route, Mamm. 62. (Fort Tejon, Cal.)—KERNERLY, P. R. R. Rep. x, 1859, Whipple's Route, Mamm. 13, pl. 11. (California.)—GERR., Cat. Bones Brit. Mus. 1869, 363. (California.)
- Thomomys talpoides bulbivorus*, COUES, Proc. Acad. Phila. 1875, 136.—COUES, Powell's Rep. Colorado R. 1875, 268 (monograph).
- Oryzomys (Saccophorus) botta*, EYD. & GERV., Mag. de Zool. vi, 1836, 23, pl. 21, f. 4 (teeth); Voy. Favorite v, 1839, 23, pl. 8, f. 4 (same).
- Thomomys botta*, LESS., Nouv. Man. R. Anim. 1843, 119. (Compiled.)—BAIRD, Proc. Acad. Nat. Sci. Phila. 1855, 335. (Subsequently identified the same with *bulbivorus*.)
- Geomys fuliginosus*, SCHNEZ, Syn. Mamm. ii, 1845, 136. (Based on *douglasi*; name altered for no good reason.)
- Thomomys laticeps*, BAIRD, Proc. Acad. Nat. Sci. Phila. 1855, 335; M. N. A. 1857, 399. (Humboldt Bay.)—KERN., P. R. R. Rep. x, 1859, Whipple's Route, Mamm. 13, pl. 12, f. 1 (by error marked "2" in text). (Same as the foregoing.)
- Geomys douglasi*, RICH., F. B. A. i, 1839, 300, pl. 18 C, f. 1-6 (skull); Zool. Voy. Blossom, 1839, 9. (Near mouth of Columbia; Fort Vancouver.)—RICH., Ann. Rep. Brit. Assoc. for 1836, vi, 1837, 150.—LECONTE, Proc. Acad. Nat. Sci. Phila. 1853, 162. (Compiled from Richardson.)
- Geomys douglasi*, DEKAY, N. Y. Fa. 1849, 92. (Compiled from Richardson.)
- Ascomys douglasi*, WAGN., Suppl. Schreb. iii, 1843, 392. (Compiled.)
- Pseudostoma douglasi*, AUD. & BACH., Q. N. A. iii, 1853, 34, pl. 105 (altogether too brightly colored). (Mainly compiled from Richardson.)
- Geomys (Thomomys) douglasi*, GIERKE, Slog. 1855, 531. (Compiled.)
- Thomomys douglasi*, BAIRD, M. N. A. 1857, 394. (Minute description of specimens from Washington and Oregon Territories.)—SUCKL., P. R. R. Rep. xii, 1860, pt. ii, pp. 100, 126.

**VARIETAL CHARS.**—Coloration heavier than in the foregoing; general cast reddish-brown, lined with dusky on the back; the head usually darker than the rest of the upper parts; on the sides, the color giving way to a clearer tawny-brown, which occupies the belly also, there overlying the plumbeous roots of the fur as a strong wash. Face and mouth-parts dusky, or even sooty-blackish, contrasting with the white lining of the pouches. No pure white on the under parts. Tail and feet usually incompletely whitish, or quite dusky. If anything, averaging rather larger than true *talpoides*. Hand rather shorter than the foot, owing to less development of the claws, which are only about 0.40 long.

HABITAT.—Pacific coast and slopes of the United States, from Washington Territory to Southern California.

There is no decided difference in size or shape between this form and the last, except an *average* less development of the fore claws. The extreme of the *bulbivorus* branch of this species is readily recognized by a warmth and intensity of coloration not known to occur in specimens from the Northern Interior; the color varies a great deal, but is never the clear mouse-gray of *talpoides*, being an intimate mixture of yellowish-brown and dark brown or blackish. Above, the pointing of the fur conceals the plumbeous bases of the hairs; below, this plumbeous shows, overlaid with a strong wash of tawny or muddy-brown, unlike the hoary-gray of the same parts of *talpoides*. The under surface is not known to be varied with patches of white,\* nor is there any white about the mouth, excepting the immediate border of the lips; the mouth-parts being sooty or dusky, contrasting with the white which lines the cheek-pouches. This is very much as in *umbrinus*, and quite different from *talpoides*. The fore claws average about 0.40—rather less than more. Such typical manifestation of this form I have only seen from California; it changes insensibly into both *talpoides* and *umbrinus*. Proceeding up the Pacific coast, we find an animal still like *bulbivorus* in general tone of coloration, but in which the mouth-parts have nearly or entirely lost their sootiness; the fore claws also enlarge somewhat, and from this state it is but a step to true *talpoides*, which meets "*douglasi*" in the interior of Oregon and Washington. In the interior of California, the opposite modification begins, tending to *umbrinus*, which becomes established in Arizona and New Mexico. Here the dark mouth-parts are intensified, but the color grows richer till a decidedly tawny or fulvous cast results. Specimens from Fort Crook and Fort Tejon, Cal., and from Provo, Utah, are ambiguous, exhibiting much variation. Some of the browner ones are inseparable from *bulbivorus*, while the ruddiness of others matches that of typical *umbrinus*. The intergradation of the two forms in this region is complete. Some other specimens from Fort Crook are identical with Steilacoom ones in color; the only difference being the weaker claws. To the southward, on the coast, the same intergradation occurs, becoming established about San Diego. In Lower California, pure *umbrinus* prevails.

\* A San Francisco specimen is a perfect albino—snow-white all over.

## THOMOMYS TALPOIDES UMBRINUS, (Rich.) Coues.

## Southern Pocket Gopher.

- Geomys umbrinus*, RICH., F. B. A. 1, 1839, 308; Rep. Brit. Assoc. for 1836, vi, 1837, 150. ("Caddagucos, Southwestern Louisiana"—more likely Texas or New Mexico.)—WATSON, Charles. Mag. N. H. III, 1839, 598, f. 71 (skull).—DEKAY, N. Y. Fa. 1843, 92. (Compiled from Richardson.)—SCHINZ, Syn. Mamm. II, 1845, 137. (Compiled from Richardson.)—LEC., Proc. Acad. Nat. Sci. Phila. 1862, 164. (Compiled from Richardson.)
- Accomys umbrinus*, WAGN., Suppl. Schreb. III, 1843, 369. (Compiled.)
- Pseudostomus umbrinus*, AUD. & BACH., III, 1854, 307. (Compiled from Richardson.)
- Geomys (Thomomys) umbrinus*, GERR., SEng. 1855, 536. (Compiled from Richardson.)
- Thomomys umbrinus*, BAIRD, M. N. A. 1857, 399 (redescribed from numerous New Mexican specimens).—BAIRD, U. S. Mex. B. Survey, II, pt. II, 1859, Mamm. 41.—GERR., Cal. Bones Br. Mus. 1868, 298.
- Thomomys talpoides umbrinus*, COUES, Proc. Phila. Acad. 1875, 137.—COUES, Powell's Rep. Colorado R. 1875, 261 (monograph).—COUES & YARROW, Wheeler's Rep. Expl. W. 100 Merid. "1875" (= 1876), 111 (New Mexico, Arizona, &c.).
- Geomys fulvus*, WOODH., Proc. Acad. Nat. Sci. Phila. 1869, 301 (San Francisco Mountains, Arizona); Rep. Expl. Zuni and Colorado R. 1863, 51, pl. 5 (the same).
- Pseudostomus (Geomys) fulvus*, AUD. & BACH., Q. N. A. III, 1854, 300. (Copied from Woodhouse.)
- Thomomys fulvus*, BAIRD, M. N. A. 1857, 402. (Describes Woodhouse's type, and other specimens, from California.)—BAIRD, U. S. Mex. Bound. Surv. II, pt. II, 1859, Mamm. 41.—KERN, F. R. R. Rep. 3, 1859, Whipple's Route, Mamm. 14, pl. 12, f. 2.—COUES, An. Nat. 1, 1867, 304 (habits).—COUES, Proc. Acad. Nat. Sci. Phila. 1867, 135 (Fort Whipple, Arizona).

**VARIETAL CHAR.**—Averaging decidedly smaller than either of the foregoing. Length of head and body about six inches, rarely seven. Fore feet averaging decidedly less than the hind feet; longest claw often under than over 0.40. Color variable, from a nearly uniform rich fawn-color all over, or even intense reddish-chestnut, to various tawny-brown shades, with or without a blackish dorsal area; belly merely a paler shade of the color of the upper parts, or much as described under *bulbivorus*. (Occasionally quite gray, much as in typical *talpoides*; sometimes lustrous coal-black all over.) Mouth-parts, and often whole face, blackish, except sometimes immediately around the lips, strongly contrasting with the white lining of the pouch. Tail usually more or less like the body.

**HABITAT.**—Southern Colorado, Southern Utah and Southern Nevada, Western Texas, New Mexico, Arizona, and Lower California to Cape Saint Lucas. Southward extension into Mexico undetermined.

No other form of the genus varies so much in color as this one. The known variations are all given in the original memoir, and Drs. Coues and Yarrow have carefully described the normal or usual style of coloration in the Report above cited.

## THOMOMYS CLUSIUS, Coues.

## Rocky Mountain Pocket Gopher.

*Thomomys clusius*, COUES, Proc. Phila. Acad. 1875, 138 (descr. orig. Bridger's Pass, Rocky Mountains).—  
COUES, Powell's Rep. Colorado R. 1875, 263, f. 80 (same specimen redescribed and figured).

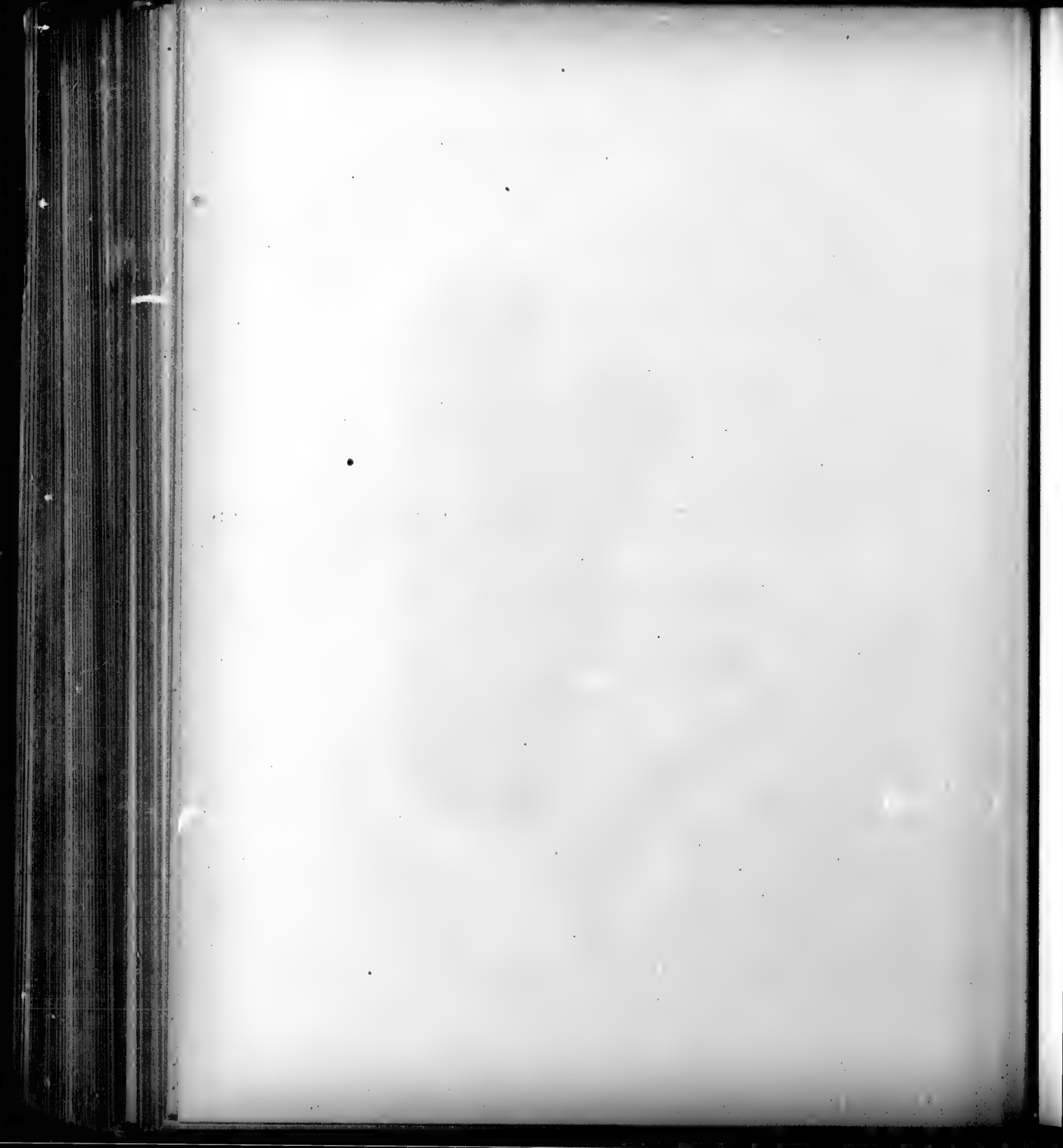
**DIAGNOSIS.**—Smallest known species of the genus. Length (♀, *adult*) about 5 inches. Feet remarkably small; sole of hind foot, 0.75; palm of hand, including longest claw, 0.65. Fore claws small, weak, little curved, the longest under 0.30. Incisors as usual in the genus. Muzzle almost entirely hairy, with a very small naked pad confined between the nostrils. Pouches ample, about 1.75 deep (measured from the beginning of the fold of skin at the side of the snout). Tail extremely short; under 1.50 in length from the true base, and little over 1.00 from the end of the conical enlargement at base; the thinly-haired portion being thus less than one-fourth the total length of head and body. Ears minute. Color above pale yellowish-gray, with a slight light-brown shade; the fur plumbeous at base, as usual. Below, nearly pure white, the fur being mostly of this color to the very base. No dark auricular area. Feet and tail white. Extremity of snout blackish. Claws and whiskers colorless. Incisors faced with orange. Mammary 6 pairs.

**HABITAT.**—The single specimen of the species at present known, No. 3081, Museum of the Smithsonian Institution, was taken at Bridger's Pass, Rocky Mountains, July 28, 1857, by Dr. W. A. Hammond.





TRONCHUS CLAMMUS, Cress. Nat. Hist.



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MONOGRAPHS  
OF  
NORTH AMERICAN RODENTIA.

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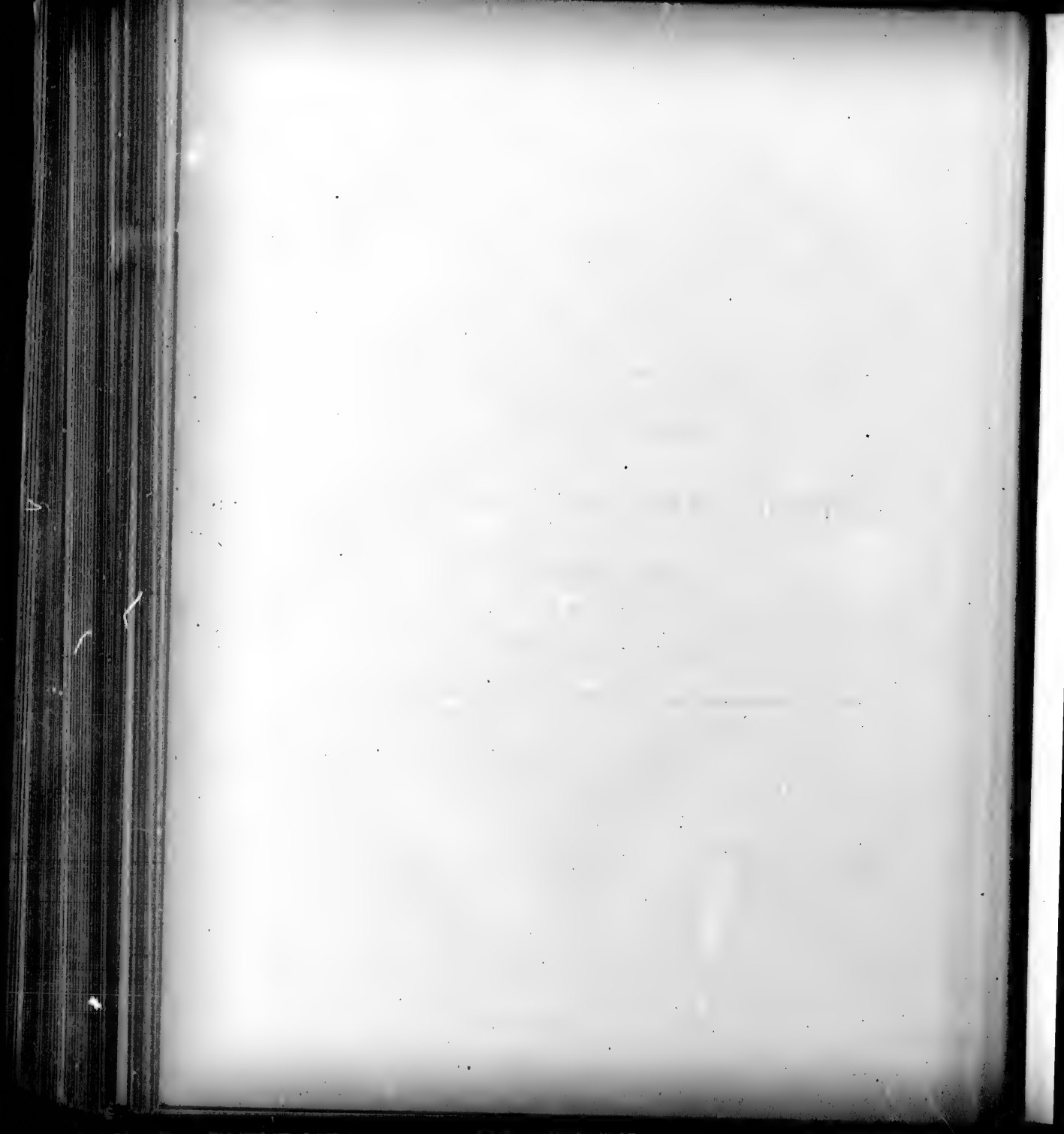
No. XI.—SCIURIDÆ.

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By J. A. ALLEN.

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## LETTER OF TRANSMITTAL.

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MUSEUM OF COMPARATIVE ZOOLOGY,  
Cambridge, Mass., March 15, 1877.

SIR: I transmit herewith for publication my memoir on the North American *Sciurida*. As only two genera of the *Sciuride* of the New World are represented south of the southern boundary of the United States, and one of these by only a single species not found north of that line, I have thought it best to include all of the New World forms in the present memoir, thereby making it a "Monograph of the American *Sciuridæ*". The extralimital species belong, with a single exception, to the genus *Sciurus*, which has its centre of development in Mexico and Central America. It has, however, representatives throughout the greater part of both Americas.

As in the case of previous monographs of this series which I have had the pleasure of transmitting to you for publication, the present memoir is based mainly on the material contained in the National Museum at Washington, including all that has been collected either by yourself personally or under your immediate direction and auspices. In addition to this, I have been able to use a large amount of material contained in the Museum of Comparative Zoölogy at Cambridge, Mass., without access to which my memoir would have been far more incomplete than it is at present. In this connection, I beg leave to express my gratitude to the officers of both these institutions for their kindness in allowing me the freest access to these magnificent collections, embracing upward of two thousand specimens of the American *Sciurida*.

I am, Sir, very respectfully, yours,

J. A. ALLEN.

Dr. F. V. HAYDEN,  
United States Geologist, etc., etc., Washington, D. C.



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<i>relictus</i> .....	939-939
<i>Tamias lavidens</i> .....	939-939
<i>Arctomys vetus</i> .....	939-939
<i>Paramys robustus</i> .....	934-934
<i>delicatus</i> .....	934-934
<i>leptodus</i> .....	934-934
<i>delicatior</i> .....	934-935
<i>delicatissimus</i> .....	935-935
<i>Sciurus nitidas</i> .....	935-935
<i>undans</i> .....	935-935
<i>parvidens</i> .....	935-935
—?.....	935-935
<i>Hesperomys ex</i> .....	935-935
<i>Myosops fraterculus</i> .....	937-937
<i>minutus</i> .....	937-937
<i>Colonyms oler</i> .....	938-938
<i>Taryms lucaris</i> .....	938-938
<i>Tillomys senex</i> .....	938-939
<i>parvus</i> .....	939-939

## FAMILY SCIURIDÆ.

The family *Sciuridæ*, as now commonly restricted, may be characterized as follows: Dental formula; I.  $\frac{1}{1}$ ; Pm.  $\frac{2}{1}$  or  $\frac{1}{1}$ ; M.  $\frac{3}{3} = \frac{1}{1}$  or  $\frac{1}{1}$ . Grinding-teeth rooted, with, during youth, tuberculated crowns; the tubercles soon becoming much modified or obliterated by attrition, generally giving rise for a time to transverse ridges. The first upper premolar, when two are present, is often minute, and is generally much smaller than the second. In strictly congeneric species, in *Sciurus* and *Tamias*, the premolars may be either two or one. Occasionally two are present in species that have usually only one. In species having a single premolar, a second deciduous premolar is generally assumed to have been present during early life, but to this there are frequent exceptions. The first upper premolar, when two are present, is always single-rooted, with a simple pointed crown, and is often so minute as to be apparently functionless. The other upper grinding-teeth are triple-rooted. The lower premolar is double-rooted, the last lower molar generally triple-rooted, and the others quadruple-rooted.

The skull varies considerably in form, from the short, broad skull of the arboreal Squirrels to the narrow, very much elongated skull of some of the *Spermophiles*. There is a well developed postorbital process, which may be either short, pointed, and triangular, or long, slender, and much decurved. The infraorbital foramen is small, and placed considerably in advance of the zygomatic process of the maxillary (usually about midway between the anterior premolar and the maxillo-intermaxillary suture), and varies from a narrow vertical slit to an oval or triangular opening. The palate is very broad and flat, and extends posteriorly considerably beyond the last molar (except in some exotic species), and forms a continuous uniform plane. Molar series parallel. Feet scansorial or fossorial. Tail long or short, terete and slender or bushy and distichous, always well haired. Body generally elongate,

often slender and delicate, but sometimes thick, squat, and clumsy. Hind limbs never disproportionately developed. In one group, there is a broad densely furred intermembral membrane.

The *Sciuridae* share, in common with the other *Sciuromorpha* (*Sciuromorpha* Alston = *Sciuromorpha* Brandt, emend.), the possession of perfect clavicles; a nearly perfectly free fibula; small incisive foramina, not extending into the maxillary; the obsolescence of the outer wall of the pterygoid fossæ, and the absence of an interpterygoid fissure; a small, naked muffle and a cleft upper lip. The zygomatic arch is formed mainly by the malar, and the angular portion of the mandible springs "from the lower edge of the bony covering of the lower incisor" (*Alston*).

The *Sciuridae* are distinguished from the other families of the *Sciuromorpha* by the following characters:—The *Anomaluridae* differ from the *Sciuridae* by the absence of postorbital processes, and in possessing a large ante-orbital foramen, a narrower palate, which is contracted anteriorly and deeply emarginate behind, and in having the molars non-tuberculate, flat-crowned, and with loops of enamel. The *Ischyromyidae* differ from the *Sciuridae* in having large ante-orbital foramina, a sagittal crest, and no postorbital process. The *Haplodontidae* have the grinding-teeth "rootless, simple, and prismatic", and postorbital processes are absent, etc. The *Castorida* (taking *Castor* as the type) differ from the *Sciuridae* in lacking the postorbital processes; in the molars being semi-rooted, with involutions of the enamel border; in the form of the descending ramus of the lower jaw, the disproportionately large hind limbs, fully webbed hind feet, flat, naked tail, etc. While in *Castor* the ante-orbital portion of the skull is *Sciurine*, all close resemblance to the *Sciuridae* here ceases. The *Castoroididae* differ from the *Sciuridae* through the rootless, compound nature of the grinding-teeth, in the possession of several *Castorine* features, and the structure of the pterygoid process, etc.

The family *Sciuridae* embraces a considerable variety of forms, but they so insensibly intergrade that it is almost impossible to separate them into characterizable subfamilies, the differences being wholly adaptive, and of no great importance. The passage from the one extreme of *Sciuropterus* to the other of *Arctomys* is by very gradual steps. The lithe, graceful, arboreal *Sciuri* differ but little from *Xerus* and *Tamias*, forms still partially arboreal, while *Tamias* and *Spermophilus* so intergrade that some species are doubtfully referable to the one rather than the other. The passage from *Sper-*

*mophilus* to *Cynomys* is almost again without hiatus. *Arctomys* is again not greatly different from *Cynomys* and some of the larger species of *Spermophilus*. Whatever character is taken, whether the general form, the dentition, the size of the ear, the character of the tail, the presence or absence of cheek-pouches, or even habits, and especially if all are taken collectively, no strong lines of demarcation can anywhere be drawn, and even the question of the number of properly recognizable genera is one of not easy solution. The division of the group into subfamilies, or "tribes", is generally made between *Tamias* and *Spermophilus*, the former being associated with *Xerus*, *Sciurus*, *Pteromys*, and *Sciuropterus* to form a group *Sciurina*, or "True Squirrels", and the latter (with its subdivisions) with *Cynomys* and *Arctomys* to form the subfamily, or "tribe", *Arctomyina*, or "Burrowing Squirrels". I find, however, that here no line of separation can be drawn, *Tamias* and *Spermophilus* so thoroughly intergrading that no feature serves to trenchantly separate them. A much better hiatus occurs between *Cynomys* and *Spermophilus*, or even between *Cynomys* and *Arctomys*, or again between *Sciuropterus* and *Sciurus*.

Between *Pteromys*, *Sciuropterus*, and *Sciurus*, the chief difference consists in the presence, in the two former, of a narrow, flying membrane connecting the fore and hind limbs, supported by fascia articulating with the carpus. Neither the dentition, the skull, nor the general osteology exhibits any important differences. *Xerus* differs from *Sciurus* in certain modifications of the pelage, which is sparser and harsher, and in having shorter ears and tail, and in being more terrestrial in its habits. *Tamias* still greatly resembles *Sciurus*, but has shorter ears, internal cheek-pouches, with more fossorial feet, and also differs in being more terrestrial. On the other hand, *Tamias* and *Spermophilus* are scarcely generically separable. In *Spermophilus*, two premolars are constantly present, the first variable in size, but usually functionally developed; the dentition is stronger and the grinding-teeth are more firmly implanted. The species vary in having the ear large or rudimentary; the tail long or short, terete or distichous; the skull long and narrow, especially the facial portion, and the zygomatic arches moderately expanded, or broader and relatively shorter, with heavier and more widely expanded zygomata, etc.; the general size varies from those of the size of *Tamias* to those nearly equaling *Cynomys*, and in form from extreme slenderness to species nearly or quite as thick-set as either *Cynomys* or *Arctomys*; yet no single set



of characters, or even any combination of characters, will serve for the subdivision of *Spermophilus* into distinct generic groups, or even satisfactorily definable subgenera. In the large, slender-bodied, bushy-tailed forms, there is an approach even to *Sciurus*, not only in general form but in the proportions of the skull and in the small size of the first premolar; on the other hand, the large, thick-bodied, short-tailed forms differ little either in general form or in cranial details from *Cynomys*. *Arctomys*, again, is little more than an exaggerated *Spermophilus*.

Genetically, *Arctomys* may be considered as the point of departure in the development of the family, as it is geologically one of the earliest forms of the group. *Arctomys* leads readily into *Spermophilus*, and *Spermophilus* into *Cynomys*. On the one hand, the larger, slender-bodied, bushy-tailed species of *Spermophilus* show a tendency toward *Sciurus* proper, as some of the other large forms lead toward *Arctomys* and *Cynomys*; some of the smaller species, with large ears, long, flat, bushy tails, small first premolar, and general Sciurine form, grade insensibly into *Tamias*, while *Xerus* may have come off from the short-eared, terete-tailed phase of the same rather heterogeneous group. The hiatus between some of the forms of *Tamias* and the more arboreal *Sciuri* is by no means striking, while *Pteromys* and *Sciuropterus* seem to be only more specialized types of the strictly Sciurine form, in which the already highly specialized arboreal adaptation is carried still further through the addition of a supporting membrane, enabling them to assume an imperfect mode of aerial locomotion. It hence follows that in *Arctomys* we find the most generalized type of the family; in *Pteromys* and *Sciuropterus*, the most specialized. Through *Arctomys*, also, we get a distant affiliation with other types of the Sciuriforms, especially with *Castoride* and *Haplodontide*, while *Anomalurus* may be a still further specialized offshoot in the direction of *Pteromys*.

#### SYNOPSIS OF THE GENERA.

- I. Skull and dentition essentially as in *Sciurus*; upper premolars two, the first minute; limbs united by a furred membrane, supported anteriorly by a slender bone articulating with the carpus; ears large, sparsely furred; no cheek-pouches; nail of pollex rudimentary; pelage very soft and furry; tail very broad; also small..... *Sciuropterus*.
- II. Similar in external character to the preceding, but with important differences in dentition, in respect to the relative size of the grinding-teeth and their structure; the posterior premolar and the last molar being much smaller than the first and second true molars, instead of nearly equalling them in size, and the triturating surface of the molars having a more complex system of tubercles and ridges; also large..... *Pteromys*.

- III. Skull short, broad, and rounded; postorbital processes well developed, slender, directed downward and backward; zygomatic arches usually slender, the malar expanded in a nearly vertical plane, sometimes turned slightly outward dorsally; anteorbital foramen a narrow slit, anterior to the zygomatic process of the maxillary; upper premolars either two or one (two as a rule); when two are present, the first is always small and sometimes deciduous; ears moderate, well clothed, and sometimes conspicuously tufted; no cheek-pouches; nail of pollex rudimentary; pelage generally soft, but occasionally coarse and more or less rigid; tail broad, with the hairs mostly directed laterally..... *Sciurus*.
- IV. Skull, in general form, intermediate between that of *Sciurus* and *Tamias*; postorbital processes smaller, and the nasal bones narrower (at least than in *Sciurus*); no cheek-pouches; ears very small or rudimentary; tail short, but slightly flattened; pelage harsh, consisting of flattened, grooved spines and coarse bristly hairs, with little under fur..... *Xerus*.
- V. Skull narrowed anteriorly; postorbital processes very slender, directed downward and backward; zygomatic arches more expanded and depressed anteriorly, and the plane of expansion of the malar more oblique; anteorbital foramen oval, situated in the base of the zygomatic process of the maxillary; upper premolars either two or one; when two are present, the first is generally minute; large internal cheek-pouches; ears of medium size, well clothed, but never tufted; pollex with a well developed nail; tail rather broad, but shorter and much narrower than in *Sciurus* and *Sciuropterus*; pelage soft; dorsal surface with longitudinal stripes; also rather small..... *Tamias*.
- VI. Skull variable in form, being either narrow and elongate or short and broad, much as in *Sciurus*; postorbital processes generally triangular, strong, and directed downward; zygomatic process of the maxillary depressed and expanded; plane of the malar bone turned outward, sometimes expanded nearly horizontally; zygomatic arches spreading; anteorbital foramina placed more anteriorly than in *Tamias*, much as in *Sciurus*, but rather larger and more circular, with a strongly developed tubercle at the outer lower border; upper premolars always two the first variable in size, but always larger than in the preceding genera, in some species relatively nearly as large as in *Cynomys*; grinding-teeth in some species nearly as in *Sciurus*, increasing in size in other species till nearly as strong as in *Cynomys*; cheek-pouches well developed; body slender or thick-set; tail long, moderate, or short; ears large, medium, or rudimentary, never tufted; nail of pollex generally rudimentary; character of the pelage and pattern of coloration variable..... *Spermophilus*.
- VII. Skull strong and massive, rather short and broad; zygomatic arches widely expanded; malar rather slight, its plane oblique; muzzle narrow; postorbital processes long, strong, and directed downward; anteorbital foramina rather large, subtriangular, thrown outward basally, and placed well forward; upper premolars two, the first large, of the same breadth antero-posteriorly as the other grinding-teeth; dentition very heavy, the grinding-teeth with the transverse breadth twice the antero-posterior, the last molar much larger than the others, and subtriangular; the molar series strongly convergent posteriorly; body heavy, thick-set; cheek-pouches not large; tail short; ears rudimentary; nail of pollex well developed; pelage short and rather harsh..... *Cynomys*.
- VIII. Skull with the dorsal outline nearly straight; frontal region flat or depressed; in other respects the form is much as in *Cynomys*, but with heavier postorbital processes, not (or but slightly) decurved, much weaker dentition, and the molar series parallel; interparietal and occipital crests much more strongly developed than in the other genera; size large; body stout, broad, depressed; cheek-pouches absent or small; tail short, bushy; ears small; nail of pollex broad, flat; pelage coarse, heavy..... *Arctomys*.

In the first five genera, the skull is more or less convex above, being in the first three highly arched, but generally much less so in *Spermophilus*, and still less in *Cynomys*, while in *Arctomys* it is nearly straight. The postorbital processes become much heavier in *Cynomys* than in the preceding genera, but reach still greater development in *Arctomys*. The skull is generally destitute of ridges for muscular attachment, but such ridges are generally traceable in aged individuals, even in *Sciurus*, in which, however, they are widely separated, converging posteriorly. In most of the *Spermophiles*, they are more

strongly developed than in *Sciurus*, are placed higher up on the skull, and unite more anteriorly to form a short interparietal crest; in *Cynomys*, these ridges meet in very old individuals at only a short distance behind the post-orbital processes, and form thence posteriorly a slight interparietal crest. Though present in even comparatively young specimens, this crest has a less anterior extension. In *Arctomys*, the interparietal and occipital crests are, in the adults, strongly developed. The antero-posterior thickness of the incisors varies with the general form of the skull and with the nature of the food. In the arboreal Squirrels, which feed largely upon hard nuts, the antero-posterior diameter at the base is two to three times greater than the transverse; in *Tamias* and the most Sciurine *Spermophiles* (as *Sp. grammurus*), the antero-posterior diameter is only twice the transverse or less; in the more slender *Spermophiles*, with elongate skulls, which feed on herbaceous vegetation, the two diameters are more nearly equal, and the teeth relatively much smaller and comparatively slender. The outer edges are also rounded, while in the arboreal Squirrels, and those with strong incisors, the outer side is flat.

#### GEOGRAPHICAL DISTRIBUTION AND VARIATION.

Representatives of the *Sciuridae* are found throughout all the continental lands of the globe except Australia, but they are by far the most numerous in the Northern Hemisphere. *Sciurus*, with the exception named, is nearly cosmopolitan; *Cynomys*, on the other hand, is restricted to a comparatively small portion of North America. *Arctomys*, *Tamias*, *Spermophilus*, and *Sciuropterus* are found throughout the temperate and cold-temperate portions of the Northern Hemisphere, *Spermophilus* reaching its greatest numerical development in North America. *Pteromys* occurs only in the tropical portions of Asia, and *Xerus* is limited to Africa. The *Sciuridae* are represented in South America by only the single genus *Sciurus*, and by comparatively few species, which are generally not numerously represented in individuals. Passing northward, the *Sciuri* are much more abundant in Central America and Mexico, the genus being represented in Southern Mexico by more species than elsewhere, in any equal area, in the New World. In the United States, rarely more than three species occur anywhere together, while north of the United States the genus is represented by only a single species. Europe has likewise only a single species, but a considerable number occur in Asia and others in Africa.

Owing to the great tendency to variation exhibited by the Squirrels everywhere, both individually and geographically, especially among the *Sciuri*, it is difficult, with our present inexact knowledge of the subject, to compare satisfactorily one geographical region with another in respect to the number of species actually existing in different parts of the world. The species occurring in North America north of Mexico have been studied more carefully, and with far better facilities in the way of material, than those of any other equal area, with the result of greatly reducing the number of species formerly recognized. During the last twenty-five years, the number of supposed North American *Sciuri* has been reduced from twenty-seven species to six, with six or seven additional geographical races, or subspecies. It is but fair to suppose that those of Mexico, of Asia, and of Africa, when equally well known, will be similarly reduced, especially those of Asia, where authors have evidently excessively multiplied synonyms.\* Professor Baird, in 1857, in elaborating the large amount of material then at his disposal, found it necessary to reduce the number of North American *Sciuri* (exclusive of those of Mexico), from the twenty-seven previously supposed to exist to twelve,† while the subsequent great increase of available material now renders it apparent that the number of non-intergrading forms is one-half less than he felt authorized in retaining.

In respect to the subject of individual and geographical variation among our Squirrels, I cannot refrain from quoting Professor Baird's judicious observations, especially since he was the first to call attention to the great variability of the North American *Sciuri*. In his great work on the Mammals of North America, published in 1857, he says:—

"The determination of the species of Squirrels of North America has always been a matter of great difficulty, owing to many different reasons. The species themselves exhibit an unusual tendency to run into varieties of color, among which red, gray, and black are the predominating ones, with all

\* Dr. Gray, in 1867 (see Ann. and Mag. Nat. Hist. ser. vol. xx), recognised forty-three species of *Sciuri* (= *Microtus* and *Sciurus* Gray) from Asia, ten from Africa, and forty from America, nearly half of the latter being described by him (in a single paper) as new (besides many "varieties"), all from the warmer parts of the two Americas, while a large proportion of the names previously given by other authors to the *Sciuri* of Mexico and Central and South America were left unidentified. A single species (*Sciurus vulgaris*), quite variable in color, he properly allowed to represent the genus in Europe; while, in respect to the species of North America, he wisely accepted the reductions made by Professor Baird. With a large amount of material before me, I am unable to recognize more than fourteen species, with a few additional varieties, and believe that this number will have to be still further reduced as additional material becomes accessible.

† Two of these were doubtfully admitted.

possible intermediate shades; these varieties are sometimes more or less constant in particular localities, sometimes changing with every litter. I am not aware that there is any material difference of color at different seasons or ages in the same animal.

"Another source of perplexity to the naturalist is the alteration in average size with the latitude. Many of our animals become smaller as we proceed southward, until, on the seacoast of Georgia, Florida, and the Gulf, they reach their minimum. This is very strikingly seen in the common Deer [*Cariacus virginianus*], which on the sea islands of Georgia is so small as to be readily lifted and thrown across a horse with perfect ease by a man of ordinary strength. It is in the *Sciuridae* that, next to the Deer, we find this law to prevail most decidedly. Nearly all the species of extensive north and south range will be found, on careful examination, to substantiate this position.

"A similar variation in color to that of the Squirrels is seen in the Foxes and Wolves, [\*] most strikingly in the former. It is now well known that the Red, Cross, and Black Foxes are identical in species, the same litter frequently embracing all the colors, and that some of these varieties again are more or less permanent, while the more boreal the locality the greater the tendency to black. This is the case also with the Squirrels, where the smaller species assume the black pelage to the greatest extent in the more northern portions of the United States.

"As a general rule it may be stated that when a Squirrel exhibits any annulations of the fur on the throat or belly it is a variety of some species, typical specimens of which have the under parts either uniformly white or reddish to the roots, which, however, are sometimes plumbeous. In every such instance that has come under my examination I have had no difficulty in tracing it to its proper type. Such annulation is usually accompanied by a dusker color of the pelage. The tendency to annulation below is strongest in the Squirrels of the Mississippi Valley, and applies both to gray and fox-colored species. No such instances of annulation have yet come under my notice among the Squirrels west of the Rocky Mountains. As a general rule the bones of the entire skeleton of the Fox Squirrels, or those with rusty bellies, are red, while the white-bellied varieties have them white.

"After carefully examining a large number of American Squirrels I

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\* See also on this point Bull. U. S. Geol. and Geogr. Surveys of the Territories, vol. II, pp. 313-321, July, 1876.

have reluctantly come to the conclusion that very many of the species borne on the scientific records must be dropped, or reduced to the position of temporary or local varieties. I hope to be relieved from the imputation of wanton and unnecessary reduction in the number of species when I state that the species already published as new by myself have in nearly every case shared the fate of others of older date. The nominal species have usually been based on varying size or different colors of different specimens. The dusky varieties and those with the hairs of the under parts annulated have in nearly every instance been raised to the rank of a distinct species.

"In the following pages it will be seen that I recognize only twelve species of Squirrels [*Sciuri*] as satisfactorily proved to belong to the United States, and should *S. limitis* and *castanotus* prove to be nominal ones, as it is not at all unlikely [and as has been found to be the case], the number will be reduced to ten from the twenty-four given by Audubon and Bachman."\*

As already stated, a great increase of material has shown that not only was the reduction in the number of species of North American *Sciuri*, made by Professor Baird in 1857, made with good reason, but that a still further reduction was necessary. In 1874, in a preliminary paper on the North American *Sciuridæ*,† I felt authorized in reducing the number of *Sciuri* from the twelve recognized by Professor Baird to five distinct and definable species and about seven additional subspecies or intergrading geographical varieties. Owing to the large amount of variation with locality, obviously resulting from climatic and geographical causes, the number of properly recognizable or namable varieties is in a measure a matter of opinion or individual preference; and, though aware that others might deem a larger number of namable varieties admissible, I do not judge it necessary to depart much from the number adopted in my synopsis of the group published three years ago. From that paper, in which I referred somewhat at length to the general subject of geographical variation among the North American *Sciuridæ*, I quote the following, with some slight verbal alteration:—

"Among the Squirrels, this increase [in intensity of color from the north southward] is finely illustrated in *Sciurus hudsonius* and in *Tamias striatus*, representatives of which from the southern parts of New York and Pennsylvania are much more highly colored than are those from Northern New Eng-

\* Mammals of North America, pp. 244, 245.

† Proc. Acad. Nat. Hist. vol. xvi, pp. 276-294, Feb. 1874. By inadvertence, the list of species was said to include all the species found "north of the Isthmus of Panama", instead of north of Mexico.



land and the British Provinces. *Sciurus carolinensis* is perhaps a still more marked example, in which the color varies from the light pure gray of the upper parts in New England specimens, with a restricted pale yellowish-brown dorsal area, to the rusty-gray dorsal surface of the Florida type, in which the whole upper surface is usually strongly yellowish-rusty. This increase of color southward is, however, still more strongly marked in the Fox Squirrels of the Mississippi Basin—the so-called *Sciurus 'ludovicianus'*. In specimens from Ohio, Northern Illinois, Southern Michigan, Wisconsin, and Iowa, the lower parts are pale fulvous, varying in some specimens to nearly white. In Southern Illinois, and at St. Louis, Mo., the color increases to a strong bright fulvous, while in specimens from Lower Louisiana the color is reddish-fulvous or deep orange. At the same time, the color of the dorsal surface becomes proportionally darker at the southward, through the greater breadth of the black annulations at the tips of the hairs, the dorsal surface in Louisiana specimens being many shades darker than in those from the Upper Mississippi. This variety also finely illustrates the variation in color seen in specimens from comparatively dry and moist regions, its habitat extending up the Missouri and its western tributaries to a point considerably above Sioux City. Beginning with Ohio specimens and passing westward, we find an increase of color in those from Northern Illinois, Wisconsin, and Iowa, west of which point the color rapidly decreases in intensity, Nebraska [and Dakota] specimens being much paler than those taken on the same parallel near the Mississippi River. Specimens from the Indian Territory are also very much paler than those from St. Louis, as are Texas ones than those from Louisiana. Even between specimens from the prairies of North-western Louisiana and others from the lowlands of the same State, near the Mississippi River, the difference in color is very strikingly marked."

In addition to the variation in color with latitude referred to above, there is, as is now well known, an equally well marked, if not even still greater, variation in color between representatives of the same species in respect to longitude, in not only the Squirrels, but among both Mammals and Birds that range across the continent. In respect to this variation in the Squirrels, I have already spoken, in the above-cited paper, substantially as follows:—

"But few specific forms, however, have a sufficiently wide range to illustrate the variations that obtain along a given parallel across the whole breadth of the continent, the *Sciurus hudsonius* group being the only instance

among the Squirrels. Others, however, show the transition that obtains in passing from the moist, fertile prairies of the Mississippi Valley to the dry plains, or from the deserts and mountainous districts of the interior to the moist region bordering the Pacific coast north of the parallel of 40°. *Spermophilus tridecem-lineatus* furnishes a good illustration of the differences in color that occur between representatives of the same species living on the moist, fertile prairies and those inhabiting the dry, barren plains, those from Illinois, Wisconsin, Minnesota, and Iowa being much darker than those from Western Nebraska, Western Kansas, and Colorado. Even specimens from Eastern Kansas are much darker than those from the middle and western portions of the same State. In this species, the color is varied, in passing from the prairies to the plains, not only by the lighter shade of the dark ground-color, but by the considerably greater breadth of the light spots and stripes in the specimens from the plains. The *Spermophilus grammurus* group (composed of the *S. grammurus*, *S. beecheyi*, *S. douglassi*, etc., of authors) illustrates not only a similar variation in intensity of color between the inhabitants of dry and moist regions, but also a somewhat changed style of coloration. Beginning with the nearly uniformly gray or grizzled type of Texas and Southeastern New Mexico, we pass to the more rufous or reddish phase of the central portions of the Rocky Mountains (in Colorado), which also has an increased amount of hoariness on the sides of the neck and shoulders, to the form west of the Sierra Nevada Mountains, typically representing the *Spermophilus beecheyi*, in which the hoariness forms broad lateral bands separated by a narrow brown medial stripe. This form in Northern California passes into the so-called *Spermophilus douglassi*, which differs chiefly from *S. beecheyi* in having the medial stripe darker, or nearly black.

"Two of the most instructive and interesting groups of the *Sciuridæ*, in this connection, are those of the common *Sciurus hudsonius* and *Tamias quadrivittatus*, [\*] the former ranging over the northern half of the continent, and the latter extending over the western half of North America and Eastern Asia. In the *Sciurus hudsonius* group, we have at the east the well-known Chickaree (*S. hudsonius*), extending westward to the Plains and northwestward to Alaska, with its brighter and smaller southern form in the Eastern Atlantic States. On the arid plains of the Platte and Upper Missouri Rivers, it presents a markedly paler or more fulvous phase, well illustrated by speci-

\* *Tamias asiaticus* of the present memoir. See postea, the account of the genus *Tamias*.



mens from the Black Hills. This form becomes even still paler and more fulvous at the eastern base of the main chain of the Rocky Mountains, between latitude 43° and 47°, where it begins to pass by insensible stages of gradation into the so-called *Sciurus richardsoni* of the Rocky Mountains north of 45°, and the so-called *Sciurus fremonti* of the Rocky Mountains south of about the same parallel. In the collections made in Western Wyoming, near the Yellowstone Lake, occur many specimens which are so exactly intermediate between the three forms (*S. hudsonius*, *S. richardsoni*, and *S. fremonti*), whose habitats here meet, that it is impossible to say which of the three they most resemble. At the same time, specimens can be selected which will form a series of minute gradations from the pale form of *hudsonius* from the Plains, on the one hand, to the *richardsoni* and *fremonti* forms on the other. To the southward of this district we soon pass into the region of the typical *fremonti*, and to the westward and northward into the habitat of the *richardsoni* type. Even the country about the sources of the Gros Ventres Fork of the Snake River is already within the range of the true *richardsoni*.\* The habitat of *S. richardsoni* extends from the main chain of the Rocky Mountains, north of latitude 44°, to the Cascade Range. Here it becomes mixed with *S. douglassi*, which scarcely differs from *S. richardsoni*, except in being a little darker above, and in having the ventral surface more or less strongly tinged with buff, varying in different specimens from cinereous to pure buff. This form prevails from the Cascade Range to the Pacific coast, southward to Northern California, and northward probably to Sitka. In Northern California, the *S. douglassi* meets the range of the true *S. fremonti*, between which two forms there is here the most gradual and intimate intergradation. In this group, we have hence four forms, which in their extreme phases of mutual divergence, appear as diverse as four good congeneric species need to, but which, at points where their respective habitats join, pass into each other as gradually as do the physical conditions of the localities at which their extreme phases are developed.

"The *Tamias quadrivittatus* group† presents an equally, or even more, striking range of variation in color, and also varies to an unusual degree in

"\* While the prevailing color above in *S. hudsonius* is light yellowish-brown, varying to bright ferruginous along the middle of the back, in *S. richardsoni* it is dull rusty or dark chestnut-brown, and in *S. fremonti* pale brownish-gray. The prevailing color of the tail in *S. hudsonius* is usually yellowish-rusty, varying to dark ferruginous, with broad annulations of black; in *S. richardsoni*, it is black, varied more or less with rusty; in *S. fremonti*, black, varied with gray."

"† *Tamias quadrivittatus*, *T. pallasi*, *T. townsendi*, and *T. dorsalis* of American authors."

size. Beginning at the northward, we find that specimens from as far south as Pembina, and thence northward, are quite undistinguishable from specimens from Northeastern Asia, or the so-called *Tamias 'pallasi'* (*T. pallasi* Baird = *T. striatus* of most European authors). This form is found to only a limited extent south of the northern boundary of the United States, where, on the plains of the Upper Missouri, it passes into the blanched, pallid form of *T. quadrivittatus* (*T. quadrivittatus* var. *pallidus* nobis,—see beyond), and further westward into the true *T. quadrivittatus* of the Rocky Mountains, and still further westward into the so-called *T. townsendi* of the Pacific coast. In this group, the greatest pallor is reached on the plains of the Yellowstone, and in the deserts of Nevada, Utah, and Arizona. In the central portions of the Rocky Mountains (Colorado and portions of New Mexico), a form is developed, distinguished by its generally bright, strong colors, but especially for the rich fulvous tints of the sides of the body, to which there is but a slight tendency either in the northern form or the pallid form of the plains. Both, however, very gradually pass into the rufous-sided type, the pallid form wherever the plains approach the mountains (as along the eastern base of the Rocky Mountains, the Uintah, Sierra Nevada, and others of the more southern ranges), gradually becoming fulvous, while the darker northern form grades into the larger fulvous race of the more northern portions of the Rocky Mountains in Montana and Idaho. This larger fulvous race west of the main divide soon begins to assume a duller, more fuscous shade, deepening finally into the very fuscous form (*T. townsendi*) of the region between the Cascade Range and the Pacific coast. In this form, the general color increases so much in depth as to become dusky yellowish-brown, and both the light and the dark stripes become obscure, and occasionally almost entirely obsolete, through the gradual accession of color. Between the extreme phase of this fuscous type and the extreme phase of the pallid type of the Plains, in which the stripes are sometimes again partially obsolete, through the extreme lightness of the general color, the differences are very great indeed. Yet in placing the scores of specimens I have had the opportunity of examining in a geographical series, or arranging them simply according to their localities, a most thorough and minute intergradation becomes at once apparent. The difference in size, too, between northern and southern specimens, is also unusually great; the pale, southern form of the Plains, and the extremely bright, fulvous form of Colorado and New Mexico, being very much smaller

than the northern, darker form, or than the fuscous type of the northwest coast.

"As corroborative evidence that these varied types of coloration are but geographical races, it becomes interesting to observe that the light and dark and the fulvous and rufous forms, respectively, of the different species, occur over the same areas. With the fuscous type of *Tamias quadrivittatus* occur the dark types of *Sciurus hudsonius*, and the dark-backed form of *Spermophilus grammurus*, and also a peculiar dusky form of *Arctomys* and of *Lepus*, and a dark form of *Spermophilus richardsoni*. On the Plains occur pallid forms of *Sciurus 'ludovicianus'*, *Sciurus hudsonius*, *Tamias quadrivittatus*, and *Spermophilus richardsoni*. With the fulvous type of *Tamias quadrivittatus* occurs a rufous form of *Spermophilus grammurus*; but the form of *Sciurus hudsonius*, occurring over the same area, presents the exceptional condition of a minimum amount of rufous."

"In addition to the tendency to change of color with locality, there is another phase of color variation that requires, in this connection, a passing notice,—namely, *melanism*. It is now well known that almost every species of Mammal may be expected to present melanistic individuals, instances of its occurrence in the majority of the North American species being now well established. Indeed, the very fact of a melanistic phase of coloration may be looked upon as almost *a priori* evidence that the individuals presenting it belong to a melanistic race of some species whose normal color is some other tint than black, as Professor Baird long since remarked in respect to the American Squirrels. It has been supposed that the tendency to melanism is more prevalent at the northward; but such does not appear to be necessarily the case. Among the *Sciuridae*, for instance, a group rather remarkable for a tendency to melanistic varieties, the black and dusky forms are as often southern as northern. In some species, melanistic individuals are as rare as are the cases of albinism, as in *Sciurus hudsonius*, the species of *Tamias*, and in many of the *Spermophili*, while in others they are sometimes the common, if not the prevalent, form over a considerable area, as occurs in *Sciurus carolinensis* and *Sciurus cinereus*. Melanism is also of frequent occurrence in *Sciurus aberti* [\*] and in *Spermophilus grammurus*; the latter presents a melanistic form both in Texas and Lower California. *Spermophilus parryi* has also a black race along the Yukon River, and frequent instances of melanism are

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[\* Melanism of this species largely predominates over the normal coloration in Colorado.]

well known in all the species of *Arctomys*. In numerous instances, these melanistic individuals and melanistic forms have been described as distinct species, while in reality they are generally so sporadic in their occurrence as to render them hardly worthy of recognition, even as varieties.

"The gradual increase of our knowledge in respect to the character of these melanistic forms, and especially in regard to the extent and character of geographical variation, necessarily leads to the modification of our views in respect to the status of many forms that have formerly passed current as more or less well-established species, and also to consequent changes in nomenclature. The representatives of few groups are more variable in respect to color, even among individuals of the same species inhabiting the same locality, than the arboreal Squirrels. Add to this the considerable amount of geographical variation that obtains among them, and the very considerable changes attendant upon season in respect to the character of the pelage, and we shall no longer feel surprised at the profusion of synonyms that attach to many of the species."\*

In several species of North American *Sciuri*, a tendency to fulvous- or rufous-bellied forms is noticeable. This is commonly developed at the southward, but in one instance occurs in the moist region of the Pacific coast, north of the fortieth parallel, namely, in *Sciurus hudsonius* var. *douglasi*. It also prevails to a marked degree in all three of the varieties of *Sciurus niger* (including the *S. "cinereus"*, *S. "vulpinus"*, and *S. "ludovicianus"*), but especially in that (var. *ludovicianus*) inhabiting the Mississippi Valley, where, as already noted, there is a marked increase in the intensity of the rufous of the ventral surface in passing southward from the Great Lakes to the Gulf. *S. collicii*, which ranges northward to Arizona, also runs into a rufous-bellied phase in Mexico, while all of the other species found south of the United States are either always orange or dark rufous below, or present this coloration as the prevalent or normal one; white- or grayish-bellied specimens of any species from the warmer parts of the two Americas being exceptional. Not only, also, is there a greater tendency to redness on the ventral surface, but this color often involves the outer (as well as the inner) surface of the limbs, and frequently extends high up on the sides of the body, especially anteriorly. The dorsal surface is also quite generally suffused with either bright fulvous or rufous, while the middle of the lower surface of the tail is,

\* Proc. Bost. Soc. Nat. Hist. vol. xvi, 1874, pp. 277-282, 284, 285.

as a rule, deep fulvous or rufous, unless displaced by melanism. In Southern Mexico and the States of Central America and Northern South America, the whole pelage often becomes wholly red,\* or red varied with black. The *S. astuans* of Brazil also runs into ferruginous phases in the Central American States. In Mexico and Central America, the *Sciuri* exhibit a strong tendency to melanism, dusky or wholly black phases of coloration occurring with greater or less frequency in all of the species from this region known to me.

The difficulty of distinguishing the species, especially merely by the study of museum specimens, is hence very great. While the *Sciuri* of North America have presented perplexing phases of coloration, those of the warmer parts of the continent do so to a far greater degree, several of the species presenting variations of color at one and the same locality greater even than does the highly variable Fox Squirrel of our Southern Atlantic and Gulf States. Of some of the species, no two specimens in series of large extent, from nearly the same locality, can be found that do not more or less widely differ in color. The widely distributed *Sciurus astuans* of South America is, however, remarkably constant in its coloration over a very extensive area, differing much less even than does the eastern form of *Sciurus hudsonius*, or any of the North American *Sciuri*, excepting perhaps *S. fuscus*. Under these circumstances, it is surprising that more synonyms have not arisen.

In addition to the purely geographical variation in color that the Squirrels, in common with other Mammals, present, there are other variations dependent upon season and age. Among the first are the presence or absence of ear-tufts in some of the *Sciuri*, the length and softness of the pelage, the variable degree of hairiness of the soles of the feet, and, in some species, differences of coloration. With differences of age occur differences in dentition, in the size, and even in respect to the presence of cranial crests and ridges for the attachment of muscles, and in other features. These points, as well as geographical variation in size and color, are treated at length in the descriptions of the several species and varieties.

With these preliminary remarks, we pass now to a consideration of the genera, species, and varieties of the American *Sciuridae*; no division of the family into subfamilies or higher groups, as previously stated, being requisite.

\* Dr. Coues's studies of the variation of *Futorius frenatus* show a very instructive and parallel intensification of color to the southward, where the head becomes quite blackish, with obliteration of white stripes, and the salmon-color of the belly deepens to bright rusty or even orange red.

## GENUS SCIUROPTERUS F. Cuvier

*Sciurus* LINNÆUS (in part), and of early authors generally.

*Pteromys* G. CUVIER (in part), and of most recent authors.

*Sciuropterus* F. CUVIER, Ann. du Mus. x, 1835, 196, pl. x (type, *Sciurus volans* Linn.); Dents des Mammifères, 1835, 162, 255.

GENERIC CHARs.—Skull short, broad, highly arched, in general form almost a miniature of that of *Sciurus hudsonius*; the supranorbital notch, however, is rather deeper, and the interorbital region is rather more constricted; the orbital fossæ are relatively larger, as are also the auditory bullæ and the ears, in conformity with the more nocturnal habits of the members of this group; the pterygoid processes are more slender, and posteriorly touch the auditory bullæ. In other particulars, the skulls of *Sciuropterus* and *Sciurus* present no important differences. Premolars two, the first minute, but reaches the plane of the trituration. Limbs united by a furred membrane formed by the expansion of the skin of the sides of the body, and supported anteriorly by a slender bone articulating with the carpus and directed backward. Tail two-thirds as long as the head and body together, broad and flat, the longer hairs being chiefly directed laterally, thus forming an important aid in governing the direction of their flight-like leaps, as well as serving as a further means of support in their short flights from tree to tree. *Sciuropterus* is thus merely a modified form of *Sciurus*, possessing rudimentary powers of flight, through the support afforded by a parachute-like expansion of the skin of the sides of the body and the broad, flat tail. The pelage is dense, soft, and furry; the ears large and sparsely clothed; the colors some soft, dull shade of brown above and whitish beneath. Animals of small size, and of crepuscular or nocturnal habits.

The genus is represented in North America by a single species of wide distribution, and presenting a very wide range of geographical variation in size. A single species also represents the genus in Europe, but several other commonly recognized species occur in Asia. The *Sciuropterus volans* of Europe differs from the American *S. volucella* in its much smaller size and relatively much shorter and smaller tail, as well as slightly also in color.

The Flying Squirrels were first separated from ordinary Squirrels by G. Cuvier\* in 1800, he then giving to the group of Flying Squirrels the generic name *Pteromys*. In 1825, his brother, F. Cuvier,† separated the small Flying

\* "Leçons d'anatomie comparée, 1, 1800." The original edition of this work I have been unable to consult.

† Ann. du Mus., x, 1835, p. 196. See also Dents des Mammifères, 1835, 162, 255.

Squirrels of Europe and North America from the others under the name *Sciuropterus*, and pointed out the important differences in the form of the skull and in the structure of the teeth that mark the two groups. By subsequent writers, the two groups, *Pteromys* and *Sciuropterus*, so well characterized by M. F. Cuvier, have not been generally adopted, and *Sciuropterus*, when recognized at all, has usually been accorded only the rank of a subgenus of *Pteromys*. The two groups, however, differ widely, not only in size and other external features, but in cranial and dental characters. The species of *Pteromys* are generally exceeded in size among the *Sciuridae* only by those of *Arctomys*; they also differ from the *Sciuropteri* in having the tail long, round, and bushy, instead of distichous and laterally expanded. In *Pteromys*, the frontal region of the skull is depressed; the nasal bones are broad and swollen, and the postorbital processes are greatly developed, being relatively almost as large as in *Arctomys*. The large size of the postorbital processes and the depression of the interorbital region give to the dorsal aspect of the skull some resemblance to the skull of *Arctomys*. In respect to the dentition, the four posterior upper grinding teeth, instead of being subequal in size, as in *Sciuropterus*, are very unequally developed, the last being less than half the size of the three preceding.\* The structure of the grinding teeth is also wholly different from that met with in any other genus of this family, the triturating surface not distantly resembling that presented by *Castor*, in consequence of the deep infolding of the enamel border of the tooth. There are, however, small isolated rings of enamel in the spaces between the deep infoldings of the enamel of the border of the crown, somewhat as in worn teeth of *Erethizon*.

The species of *Pteromys* are restricted in their distribution to Southern Asia and the Indian Archipelago; those of *Sciuropterus* range over the colder portions of the northern hemisphere, extending southward to intertropical latitudes.

\* In F. Cuvier's figure of the dentition of *Pteromys* (*Dents des Mammifères*, pl. lvii), drawn from "*Sciurus pectoratus* Pall.", the second premolar (first large grinding tooth) is also much smaller than either of the two immediately succeeding. In Brandt's figures of the skull of "*Pteromys nitidus*" (*Mém. de l'Acad. Imp. des Sci. de Saint Pétersb. 6e ser., Sci. Nat. t. vii, pl. 1, figs. 1-7*), however, the second premolar is the largest of the grinding series, and I find this to be so in skulls of this species in the Museum of Comparative Zoölogy.



## SCIUROPTERUS VOLUCELLA, (Pall.) Geoff.

## American Flying Squirrel.

## Var. VOLUCELLA.

## Southern Flying Squirrel.

- Sciurus volans* CATBERT, Carolina, II, 1743, 76, 77, pl. lxxvi, lxxvii.—BRISSON, Quad. 157.—LINN., Syst. Nat. I, 1766, 89 (in part).
- Sciurus volucella* PALLAS, Nov. Spec. Glires, 1783, 351, 353.—GMELIN, Syst. Nat. I, 1788, 153.—SCHREBER, Säuget. IV, 1793, 806, pl. cxxii.—SHAW, Gen. Zool. II, 1801, 156, pl. clv.
- Pteromys volucella* DESMAREST, Nouv. Dict. d'Hist. Nat. xxvii, 1818, 406; Mamm. II, 1829, 343.—HARLAN, Faun. Amer. 1835, 187.—GRIFFITH's Cuvier, v, 1837, 269.—FISCHER, Syn. Mamm. 1839, 365.—GODMAN, Amer. Nat. Hist. II, 146.—BENNETT, Gard. and Menag. Zool. Soc. I, 1835, 155.—YARRALL, Proc. Zool. Soc. Lond. 1830-31, 38 (anatomy).—D. W. C., London's Mag. Nat. Hist. IX, 1836, 569 (habits).—EMMONS, Quad. Mass. 1840, 60.—THOMPSON, Hist. Vermont, 1842, 47.—DEKAY, Zool. N. York, I, 1843, 65, pl. xvi, fig. 2.—WAGNER, Suppl. Schreber's Säuget. III, 1843, 231.—SCHINZ, Synop. Mamm. II, 1845, 54.—AUDUBON & BACHMAN, Quad. N. Amer. I, 1849, 216, pl. xxviii.—GIEBEL, Säuget. 1855, 643.—KENNICOTT, Pat. Office Rep. Agric. for 1856, 1857, 69, pl. vii.—BAIRD, Mamm. N. Amer. 1857, 286.—THOMAS, Trans. Ill. Agric. Soc. IV, 1860, 667.—HALL, Canad. Nat. and Geol. 1861, 299.—COOPER, Proc. Cal. Acad. II, 1861.—TOMES, Proc. Zool. Soc. Lond. 1861, 291 (Guatemala).—MAXIMILIAN, Wiegmann's Arch. f. Naturgesch. 1861, 77.—ALLEN, Bull. Mus. Comp. Zool., I, 1869, 934.—GILPIN, Proc. and Trans. Nov. Soc. Inst. Nat. Sci. II, pt. III, 1870, 12.—ADAMS, Field and Forest Rambles, 1873, 99, 296 (New Brunswick).—PERKINS, Amer. Nat. VII, 1874, 133 (habits in confinement).
- Sciuropterus volucella* GEOFFROY, Dict. Class. d'Hist. Nat. xiv, 1828, 133.
- Sciuropterus volucella* var. *volucella* ALLEN, Proc. Bost. Soc. Nat. Hist. xvi, 1874, 189; Bull. Essex Inst. vi, 1874, 66.
- Sciurus acrobates* SCHREBER, Säuget. IV, 1793, pl. cxxii B (no text).
- Assepanich, SMITH, Hist. of Virginia, 1606, —; Purchas's Pilgrims, IV, 1625, 1605.
- Quimichpatien, FERNANDEZ, Nov. Hisp. 1651, 8.
- Flying Squirrel, PENNANT, Hist. Quad. 1771, 293; "Arctic Zool. I, 1784, 120"; 2d ed. I, 1792, 139.
- L'Assepan, F. CUVIER, Hist. des Mamm. livr. VIII, 1819.
- Le Poitouche d'Amérique, MADIOT, "Mém. Soc. Linn. Paris, II, 1862, 146 (habits in confinement)".

## Var. HUDSONIUS.

## Northern Flying Squirrel.

- Sciurus hudsonius* GMELIN, Syst. Nat. I, 1788, 153.
- Pteromys hudsonius* FISCHER, Syn. Mamm. 1835, 365.—BAIRD, Mamm. N. Amer. 1857, 288.
- Sciuropterus volucella* var. *hudsonius* ALLEN, Proc. Bost. Soc. Nat. Hist. xvi, 1874, 289.
- Sciurus cabrinus* SHAW, Gen. Zool. I, 1801, 157.
- Pteromys cabrinus* RICHARDSON, Zool. Journ. III, 1828, 519; Faun. Bor.-Amer. I, 1829, 193.—WAGNER, Suppl. Schreber's Säuget. III, 1843, 228.—SCHINZ, Synop. Mamm. II, 1845, 54.—AUDUBON & BACHMAN, Quad. N. Amer. III, 1863, 202, pl. cxliii, fig. 1.—GIEBEL, Säuget. 1855, 649.—GILPIN, Proc. and Trans. Nova Soc. Inst. Nat. Sci. II, pt. III, 1870, 13.—ADAMS, Field and Forest Rambles, 1873, 99, 296 (New Brunswick).
- Pteromys cabrinus* var. *alpinus* RICHARDSON, Zool. Journ. III, 1828, 519; Faun. Bor.-Amer. I, 1829, 196, pl. xlviii.
- Pteromys alpinus* WAGNER, Suppl. Schreber's Säuget. III, 1843, 220.—SCHINZ, Synop. Mamm. II, 1845, 55.—AUDUBON & BACHMAN, Quad. N. Amer. III, 1863, 206, pl. cxliii, fig. 2.—BAIRD, Mamm. N. Amer. 1857, 289.—ROSS, Nat. Hist. Rev. 1862, 374 (Liard River).—STEVENS, Hayden's Rep. U. S. Geol. Surv. Wyoming. 1871, 451.
- Pteromys oregonensis* BACHMAN, Journ. Acad. Nat. Sci. Phila. 1st ser. VIII, 1839, 101.—SCHINZ, Synop. Mamm. II, 1845, 57 ("Texas").—AUDUBON & BACHMAN, Quad. N. Amer. I, 1849, 133, pl. xv.—BAIRD, Mamm. N. Amer. 1857, 290.—COOPER, Proc. Cal. Acad. Sci. IV, 1868, 4 (Mendocino County, Cal.).
- Greater Flying Squirrel, FORSTER, Phil. Trans. LXII, 1773, 379.
- Scena River Squirrel, PENNANT, Hist. Quad. 1771; "Arctic Zool. I, 1784, —"; 2d ed. I, 1792, 141.
- Scena River Flying Squirrel, GILPIN, Proc. and Trans. Nova Soc. Inst. Nat. Sci. II, pt. III, 1870, 13.



**SPECIFIC CHAR.**—Size varying greatly with locality. Head and body ranging, in adults, from 7.50 to 4.75 inches; tail-vertebræ from 5.00 (or a little more) to 3.50; tail, with hairs, from about 6.50 to 4.25 (occasionally less). Above yellowish-brown, varying to pale reddish-brown; below white, varying to creamy-white, with sometimes a faint tinge of pale rufous; tail above generally darker than the back, especially at northern localities, where it is sometimes decidedly blackish; tail below lighter than above, varying with locality from dusky-brown to yellowish-brown, always more strongly colored than the ventral surface of the body.

Var. HUDSONIUS.

*Northern Flying Squirrel.*

**VARIETAL CHAR.**—Length, exclusive of the tail, 6.00 inches or more; tail, with the hairs about 5.00. Above dull yellowish- or reddish-brown; below white, faintly washed with yellowish; tail above dusky, often decidedly blackish on the edges and terminal half; also frequently dusky toward the end below. Habitat mostly north of the parallel of 49°, extending further southward along the Rocky Mountains and on the Pacific slope. Grades insensibly into—

Var. VOLUCELLA.

*Southern Flying Squirrel.*

**VARIETAL CHAR.**—Similar to the preceding, but much smaller. Length, exclusive of the tail, less than 6.00 inches; generally less than 5.50. Tail less dusky, often with no blackish whatever, and the general color of the body above rather more yellowish. Habitat, United States,—exclusive of the Pacific slope north of California, and the Rocky Mountains north of Colorado; and thence southward to Guatemala.

The American Flying Squirrels present a range of geographical variation in size quite unparalleled in other members of the *Sciurida*, and only equalled in some species of the *Canida*, and possibly in *Cervus virginianus*. On the other hand, the coloration is remarkably constant, almost exceptionally so, no other North American Mammal with which I am acquainted, which has so wide a geographical range, varying so little in this respect with locality. The species ranges from Arctic America into the tropical portions of the continent. I have specimens before me from points as distant as

Alaska and Louisiana, Nova Scotia and California, and from many intermediate localities. As shown by the subjoined table of measurements, there is a gradual decrease in size from the north southward. The average length of specimens (exclusive of the tail) from Arctic America is about 7.50; of specimens from near the 49th parallel, about 6.85, or a little less, ranging from 7.10 to 6.50; of specimens from Northern New England, about 5.75, ranging from 6.00 to 5.35; of specimens from Southern New England, about 5.25,\* ranging from 5.50 (or even 6.00) to 4.50; of specimens from the Gulf States, about 4.75, ranging from 5.20 to 4.30, or about one-third less than the most northern specimens.

In respect to color, specimens from the same locality sometimes differ in the color of the dorsal surface as much as do the most diverse examples from widely separated localities. There are, however, easily recognized local differences of coloration, especially in respect to the tail; but even here there is a considerable individual (or seasonal?) variation. As a rule, the specimens from north of the United States have darker tails than those from south of the parallel of 44°, while the average difference in color between northern and southern specimens is quite marked.

A series of five specimens from the Red River of the North nearly covers the whole range of variation in color exhibited by the whole series. No. 3257 (Red River Settlement) is dark fuscous-brown above, with the tail, especially the distal half, decidedly blackish, and the under parts faintly washed with rusty-fulvous. No. 3717 (same locality, December 10) is soft yellowish-brown above, with the tail much less dusky, and the under parts white, with merely the faintest tinge of yellow. No. 3718 (same locality and date) is quite similar, but shows a variation toward No. 3257. No. 11539 (Pembina, June 14) is much redder than 3717; the tail is especially brighter, with much less dusky. No. 9083 (Selkirk Settlement) is very light-colored (as light as any from any locality), being pale yellowish-brown above, with only the terminal third of the tail blackish.

\* Many of the New England specimens (mostly measured from alcoholic specimens) are evidently immature. In the case of the males, the testes are generally abdominal, and the females show no sign of having suckled young. All the males with the testes scrotal and all the females with the teats bearing evidence of maternity are of much larger size than the others. All the measurements of northern specimens have necessarily been taken from skins, some of which are evidently overstuffed. Taking, however, only such measurements as are least affected by faulty taxidermy, as the length of the feet and the measurements of the head, in cases where the skull is left in the skin (and only from such specimens are the measurements of the head given), there is evidently a very striking, as well as very gradual, decrease in size southward.

Two specimens collected on the Northwestern Boundary Survey by Dr. Kennerly (doubtless in Washington Territory) can be exactly matched, both in size and color, by specimens from Matamagaminque, Canada, except that one is more yellow below than the Canada specimens. Another, from Fort Crook, Cal., is much darker than the specimens from Washington Territory, with a strong yellowish wash below, which extends over the whole lower surface of the tail. No. 9625, from Idaho, and No. 9704, from the Uintah Mountains, are two of the darkest specimens in the collection; but in the series from Big Island, Great Slave Lake, there is one fully as dark, while one from the Red River district is scarcely lighter.

Specimens from the United States, and especially from the more southern portions, are more yellowish-brown above, with much less black on the tail, and more yellowish below, than specimens from Northern New England, Canada, and the more boreal parts of the continent. In some of the southern specimens, there is no dusky or black on the tail, which inclines to a rufous shade of brown above and yellowish-brown below.

Average southern specimens differ from average northern specimens most strikingly in size and in the length and fullness of the pelage, but also in the tail being relatively narrower, and the soles of the feet nakeder, and also quite appreciably in color, especially in the upper side of the tail being nearer of the color of the back. There is, however, no break in the sequence from north southward, either in size, color, or other characters, by which the group can be subdivided specifically, or even variably. The recognition, as above, of a northern and southern subspecies, is, in great measure, arbitrary. Apparently, those inhabiting the Rocky Mountains of Montana and the Uintah Mountains are darker in color than those from other regions, and rather more ferruginous above, running into a phase corresponding somewhat with var. *richardsoni* of the *Sciurus hudsonius* group, inhabiting the same region. Neither this form (*Pteromys alpinus* auct.) nor the so-called "*Pteromys oregonensis*" seems to me to be variably distinguishable, especially the latter, specimens of which are, sometimes at least, absolutely indistinguishable from Canadian specimens. The supposed differences in the length and direction of the carpal fascia supporting the flying-membrane, I am unable to appreciate.

In respect to differences of a strictly individual character, we meet occasionally with specimens from both the Atlantic and Pacific slope, as well as from the interior, in which the color of the lower surface of the tail is

scarcely darker or more fulvous than the ventral surface of the body; again, and more frequently, the lower surface of the tail is nearly as dark as the dorsal surface of the body, from which it differs only slightly in tint. As already noticed, the edges and terminal portion of the lower surface of the tail are occasionally strongly dusky. Commonly, the eye is encircled by a narrow dusky ring, and there is a dusky spot in front of the eye; but sometimes these markings (in light-colored specimens) are wholly obsolete. Occasionally, there is a whitish spot at the posterior base of the ear, sometimes conspicuously noticeable, while in the majority of instances no such marking is clearly distinguishable. Also, in southern specimens, the pelage of the lower surface is wholly white to the base; in others, the basal portion is dusky, as is generally the case in northern specimens, in some of which only merely the surface is whitish.

Doubtless, the small amount of variation in color with locality, apparent in this group, as in the Hares (see *antea*, p. 268), is in part owing to mode of life, these animals being not only nocturnal, but habitually passing the day-light concealed in hollow trees. They are hence apparently less exposed to the influences most active in modifying coloration.

As already intimated, the habitat of this species embraces nearly the whole of the North American continent. Its range to the northward extends apparently to the forest limit, there being specimens in the collection from Labrador, the vicinity of Great Slave Lake, Fort Liard, and Alaska. There are also specimens from Georgia, Mississippi, and Louisiana. It is well known as an inhabitant of Mexico, and Mr. Salvin collected it at Dueñas, Guatemala. Mr. Tomes refers to his specimens as having the fur a little coarser, and the color everywhere more rufous, than in specimens from the United States.\* Examples have been received from so many parts of the interior, as well as from the Pacific coast, that it may be considered as presumably dispersed throughout the wooded portions of the continent. Even where it is common, it is a species not often observed, owing to its nocturnal habits. Audubon and Bachman, in their very interesting biography of this species, speak of it as being to some extent gregarious.

The great amount of geographical variation in size presented by this species has led to the recognition of several supposed species. As early as

\* Proc. Zool. Soc. Lond. 1861, p. 381.

1772,\* Forster† described the Flying Squirrel of Hudson's Bay as the "Greater Flying Squirrel", which, he says, is "vastly different . . . in size and color" from the Flying Squirrel of New York, Pennsylvania, and Virginia. This is Pennant's "Severn River Squirrel", and the "*Sciurus volans major*" of Pallas,‡ to which Gmelin, in 1788, gave the name *Sciurus hudsonius*. Shaw, in 1801, changed Gmelin's name to *Sciurus sabrinus* in consequence of the name *hudsonius* having been also applied to the Chickaree, or Red Squirrel (*Sciurus hudsonius*). As, however, the Flying Squirrels and the Chickarees proved to belong to different genera, this double use of the name *hudsonius* becomes tenable.

The smaller Southern Flying Squirrel was described by Hernandez, from Mexican specimens, under the native name *Quimichpatlan*, in 1651, and as early as 1743 it was figured and described by Catesby from Carolina specimens. To this species (in the mean time also described by Brisson, Edwards, Pennant, Buffon, and others), Pallas gave the name *Sciurus vol-*

\* Among the many earlier references to this animal, which have, however, no direct bearing upon its technical history, are many that are interesting from their quaint character. Thus, the celebrated Captain John Smith, in his Account of Virginia, published originally as early as 1606, in alluding to this animal, says:—"A small beast they have, they call *Asapawick*, but wee call them flying Squirrels, because spreading their legs, and so stretching the largeness of their skinned, that they seeme to fly thirte or fortie yards."—(*Parochia's Pilgrime*, vol. iv, p. 1695.)

Somewhat later, the good Thomas Morton, in his "New English Canaan" (p. 82), speaks of "a little flying Squirrell, with bat like wings, which hee spreads when hee jumpes from tree to tree and does no harme".

In 1636, the Northern Flying Squirrel was also noticed by Sagard-Theodat, whose curious description is among the most detailed of the early notices of this animal. I am favored with the following transcript of his notice, through the attentions of my colleague, Dr. Coues, taken from p. 678 of vol. iii. of the 8vo French ed. of 1666, of his *Histoire du Canada*, a literal reprint of the original of 1636 (p. 745):—"Ils ont aussi trois sortes d'ecureux differens, & tous trois plus beaux & plus petits que ceux de nostre Europe. Les plus estimes & rares sont les ecureux volans, nommés Saboteuxquants, qui ont la couleur cendrée, la teste un peu grosse, le poil doux & court & les yeux petits. Ils sont appellez volans, non qu'ils ayent des ailes, mais à raison qu'ils ont une certaine peau aux deux costes prenant de la patte de derrière à celle de devant, qu'ils replient fort proprement contre leur ventre quand ils marchent, puis l'estendent quand ils volent, comme ils font aisement d'arbre en arbre, & de terre jusques au dessus."

Another writer, in an account of Virginia, originally published in 1640, speaks of "two sorts of Squirrels", one of which is "called a flying one, for that she spreads like a Bat a certaine loose skin she hath and so flies a good way".—(*Forde's Tracts*, vol. ii, No. 8, p. 16.)

Clayton, writing in 1688, in enumerating the Squirrels of Virginia, says:—"The second is the flying Squirrel of a lighter dun Colour, and much less than the English Squirrel; the skin on either side the body extended is very large betwixt the Fore-Leg and Hind-Leg which helps them much in their skipping from one Bough to another that they will leap farther than the Fox Squirrel, though much less, yet this is still rather skipping than flying, though the Distinction be well enough."—(*Forde's Tracts*, vol. iii, No. 12, p. 36.)

Lawson, in 1709, also thus refers to the Southern Flying Squirrel in terms no less strained:—" . . . He has not wings as Birds or Bats have, they being a fine thin skin cover'd with Hair, as the rest of the parts are. This from the Fore-Foot to the Hinder-Foot, which is extended, and holds so much Air as buoys him up from one Tree to another, that are greater distances asunder, than any other Squirrels can reach by jumping or springing . . ."

† Phil. Trans. vol. lxi, 1773, p. 379.

‡ Nov. Spéc. Glires, 1776, p. 354.

cella, it having been previously referred by Linnæus to the Flying Squirrel of Europe (*Sciurus volans* Linn.=*Sciuropterus volans* F. Cuv.). Richardson, in 1828, described a variety of the Northern Flying Squirrel, from the northern portion of the Rocky Mountains, under the name *Pteromys sabrinus* var. *alpinus*. Later, however, he was in doubt as to whether the differences observed merited recognition. Wagner, however, in 1843, raised Richardson's variety *alpinus* to specific rank, since which time it has passed generally current as a species, being so recognized by Audubon and Bachman, and later by Professor Baird. Bachman, in 1839, described specimens from near the mouth of the Columbia River under the name *Pteromys oregonensis*, and this name has since passed generally current as that of a valid species. The differences supposed to characterize it were, however, slight, consisting, in reality, only in its rather smaller size as compared with *P. "sabinus"*. From *P. "volucella"* it differed in being larger, and in not having the hairs of the ventral surface white to the roots, as Dr. Bachman erroneously supposed to be always the case in the Southern Flying Squirrel. This originated the four supposed species of North American Flying Squirrels. Ten years later, however, we find the following suggestive remarks in Audubon and Bachman's "Quadrupeds of North America" (vol i, p. 205), under the head of *P. "sabinus"*:—"As long as only two species of Flying-Squirrels were known in North America—the present species (*P. sabinus*) and the little *P. volucella*—there was no difficulty in deciding on the species, but since others have been discovered in the far West, the task of separating and defining them has become very perplexing."

Professor Baird, in 1858, having few specimens of the group at hand for comparison, admitted all of the four species, but evidently with some hesitation. *P. "volucella"* seemed to him to be only a miniature of *P. "hudsonius"*, the only differences perceivable to him being the larger size of the latter, with the hairs of the belly lead-colored at base instead of white throughout. Respecting the distinctness of *P. "alpinus"* from *P. "hudsonius"*, he felt unable to decide, while the validity of *P. "oregonensis"* was apparently not questioned.

TABLE I.—Measurements of seven skulls of *SCIUROPTERUS VOLUCRILLA* CUF. *VOLUCELLA*.

Catalogue-number.	Locality.	Sex.	Total length.	Greatest width.	Skull bones, length.	Upper incisors from front to hind margin of palate.	Upper incisors from front to hind margin of palate, together.	Upper molars, length taken together.	Lower jaw, length.	Lower jaw, height.
*973	Norway, Mo.....	.....	1.45	0.90	0.40	0.40	0.73	0.97	0.73	0.50
*941	Eastport, Me.....	.....	1.93	0.83	0.35	0.35	0.65	0.95	0.63	0.45
*943	Norway, Mo.....	♂	1.30	0.77	0.37	0.34	0.66	0.97	0.63	0.43
*974	Massachusetts.....	.....	1.35	0.66	0.38	0.70	.....	0.66	0.47	.....
*944	Norway, Mo.....	.....	1.45	0.98	0.43	0.40	0.73	.....	.....	.....
4846	Pennsylvania.....	.....	1.49	0.97	0.40	0.40	0.70	.....	0.98	0.50
4847	.....do.....	.....	1.37	0.65	0.37	0.40	0.60	.....	0.65	0.43

\*Specimens from Museum of Comparative Zoology, Cambridge, Mass.

TABLE II.—Measurements of seventeen specimens of *SCIUROPTERUS VOLUCELLA* CUF. *HUDSONIUS*.

Catalogue-number.	Original number.	Locality.	From tip of nose to—				Tail to end of—		Length of—		Nature of specimen.
			Eyes.	Ears.	Occiput.	Tail.	Vertebrae.	Hairs.	Fore feet.	Hind feet.	
9995	.....	Tonga, Alaska.....	.....	.....	.....	7.50	5.00	6.95	0.90	1.35	Skin.
5626	.....	Fort Liard, H. B. T.....	.....	.....	.....	7.40	5.00	6.00	0.90	1.50	..do.
7009	.....	Big Island, Great Slave Lake.....	0.70	1.45	1.55	7.30	5.40	6.40	0.90	1.40	..do.
6504	.....	do.....	0.65	1.90	1.65	7.50	4.95	5.95	0.85	1.30	..do.
3718	.....	Red River.....	0.65	1.90	1.47	7.30	4.10	5.10	0.75	1.45	..do.
3837	.....	do.....	0.70	1.35	1.60	7.00	6.00	7.95	0.90	1.50	..do.
3717	.....	do.....	0.65	1.90	1.60	7.50	.....	.....	0.85	1.45	..do.
3313	.....	Fort Hollingham, Wash. Ter.....	.....	.....	.....	7.50	4.00	5.00	0.90	1.50	..do.
.....	418	Washington Territory.....	.....	.....	.....	6.00	4.50	5.50	0.90	1.55	..do.
3849	.....	Fort Crook, Cal.....	.....	.....	.....	7.00	4.50	5.95	0.90	1.35	..do.
9704	335	Utah Mountains.....	.....	.....	.....	6.40	4.75	5.75	0.90	1.45	..do.
9896	.....	Idaho.....	0.57	.....	.....	6.75	4.00	5.50	0.90	1.55	..do.
7189	.....	Matagumiqua, Canada.....	0.67	1.95	1.60	7.10	5.50	6.50	0.85	1.35	..do.
7104	.....	do.....	.....	.....	.....	6.75	5.35	6.50	0.85	1.45	..do.
7101	.....	do.....	.....	.....	.....	7.00	5.50	6.60	0.90	1.50	..do.
7190	.....	do.....	.....	.....	.....	7.10	.....	.....	0.90	1.60	..do.
7193	.....	do.....	.....	.....	.....	6.50	3.75	4.50	0.90	1.50	..do.



TABLE III.—Measurements of thirty-six specimens of SCIUROPTERUS VOLUCELLA var. VOLUCELLA.

Catalogue number.	Locality.	Sex.	From tip of nose to—				Tail to end of—		Length of—		Height of ear.	Nature of specimen.
			Eye.	Ear.	Occiput.	Tail.	Vertebra.	Hair.	Fur foot.	Hind foot.		
3113	Calais, Me.	♂	0.87	1.50	1.75	5.90	4.50	5.50	0.83	1.40	0.65	Alcoholic.
506	Norway, Me.	♂	0.67	1.33	1.63	5.35	4.65	5.75	0.75	1.30	0.65	do.
1171	Upton, Me.	♂	0.70	1.20	1.85	5.20	4.75	5.35	0.78	1.40	0.65	do.
3078	Norway, Me.	♂	0.68	1.30	1.55	5.10	4.35	5.40	0.65	1.40	0.63	do.
3787	do.	♂	0.65	1.33	1.55	5.50	4.65	5.90	0.73	1.40	0.75	do.
3036	do.	♂	0.60	1.13	1.25	5.35	4.50	5.55	0.60	1.42	0.76	do.
3037	do.	♂	0.60	1.25	1.55	5.13	4.15	5.10	0.67	1.30	0.60	do.
500	do.	♂	0.70	1.30	1.67	6.00	4.40	5.35	0.87	1.38	0.74	do.
do.	do.	♀	0.70	1.30	1.65	5.70	4.90	6.00	0.80	1.45	0.71	do.
1001	Amherst, N. H.	♂	0.70	1.25	1.55	5.65	4.70	5.75	0.85	1.45	0.67	do.
968	Milan, N. H.	♀	0.71	1.34	1.65	5.85	4.75	6.00	0.82	1.57	0.75	do.
4971	Dummer, N. H.	♀	0.64	1.15	1.50	5.30	4.10	4.65	0.67	1.33	0.70	do.
4641	Waterville, Me.	♀	0.65	1.27	1.60	5.50	4.75	5.67	0.75	1.45	0.67	do.
880	Lynn, Mass.	♂	0.57	1.07	1.37	4.35	3.50	4.25	0.65	1.16	0.53	do.
5736	do.	♂	0.57	1.00	1.45	4.50	3.65	4.30	0.67	1.17	0.54	do.
3599	Massachusetts.	♀	0.60	1.10	1.50	5.15	4.00	5.00	0.68	1.23	0.59	do.
896	do.	♂	0.60	1.08	1.60	5.10	3.90	4.60	0.75	1.25	0.54	do.
3597	Massachusetts.	♀	0.60	1.06	1.44	5.30	.....	.....	0.71	1.25	0.55	do.
3599	do.	♂	0.60	1.00	1.50	5.00	3.90	3.90	0.73	1.30	0.57	do.
763	Burlington, Iowa.	♂	0.60	1.10	1.42	5.10	3.70	.....	0.73	1.16	0.50	do.
2630	Cook County, Ill.	♀	0.60	1.15	1.43	4.60	4.00	4.70	0.70	1.17	0.56	do.
1563	Massachusetts.	♂	0.60	1.10	1.45	5.50	3.95	4.15	0.75	1.23	.....	Skin.
1564	do.	.....	0.55	0.93	1.35	4.75	3.50	4.25	0.73	1.15	.....	do.
1979	Hudson, Mass.	.....	0.58	1.13	1.45	6.35	4.50	5.50	.....	1.33	.....	do.
2509	Middleboro', Mass.	.....	0.60	1.10	1.50	4.70	3.40	4.90	0.67	1.20	.....	Alcoholic.
2509	do.	.....	0.60	1.10	1.50	4.70	2.70	4.40	0.60	1.20	.....	do.*
2310	do.	.....	0.50	1.00	1.35	3.40	2.80	3.00	0.70	1.14	.....	do.*
2394	Columbus, Ga.	.....	0.60	1.20	1.50	4.75	3.60	4.20	0.73	1.19	.....	do.*
2525	do.	.....	0.55	1.14	1.46	4.25	3.50	4.10	0.70	1.10	.....	do.*
2564	West Northfield, Ill.	.....	0.60	1.20	1.50	4.75	3.60	4.30	0.73	1.22	.....	do.*
786	Columbus, Miss.	.....	.....	.....	.....	5.00	3.60	4.10	.....	1.10	.....	do.*
787	do.	.....	.....	.....	.....	4.70	3.40	3.90	.....	1.06	.....	do.*
11130	Bladenburg, Md.	♀	0.55	1.07	1.45	5.10	3.50	4.10	0.75	1.20	.....	do.
9506	Prairie Mer Rouge, La.	.....	0.50	0.95	1.44	5.30	3.35	3.90	0.75	1.10	.....	do.
4915	New Orleans, La.	♂	0.58	1.15	1.50	4.60	3.67	4.10	0.75	1.20	0.52	do.
7261	Grand Coteau, La.	♀	0.57	1.10	1.50	4.85	3.30	3.95	0.64	1.15	0.50	do.

\* Measurements from Baird's Mamm. of North America, p. 295.



TABLE IV.—List of specimens examined of *SCIUROPTERUS VOLUCELLA* var. *HUDSONIUS*.

Catalogue-number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
9994				Tongue, Alaska		Lieut. F. W. King	Lieut. F. W. King	Skin.
9925				do		do	do	do
4579				Arctic America		R. Kennicott	R. Kennicott	do
5655				Fort Liard, H. B. T.		W. L. Hardisty	W. L. Hardisty	do
5656		1000		do		do	do	do
6504		1989		Big Island, Great Slave Lake		B. R. Ross	J. Reid	do
6505		1985		do		do	do	do
7069				do		do	do	do
8107		881		Fort Resolution	Apr. 4, 1864	J. Lockhardt	J. Lockhardt	do
7189				Matanagamingue, Canada		Thomas Richards	Thomas Richards	do
7190				do		do	do	do
7191				do		do	do	do
7192				do		do	do	do
7193				do		do	do	do
7194				do		do	do	do
9639				Labrador		Dr. J. B. Gulpin	Dr. J. B. Gulpin	do
3857				Red River Settlement		D. Gunn	D. Gunn	do
3717			♂	do		do	do	do
3718			♀	do		do	do	do
9063				Selkirk Settlement		do	do	do
9064				do		do	do	do
11530		9079	♀	Fort Pembina, Minn.		A. Campbell	Dr. E. Cones	do
193				Pembina, Minn.		C. Cavalier	C. Cavalier	do
636				Montreal, Canada		Thomas Broome	Thomas Broome	do
3283				Halifax, N. S.		Dr. J. B. Gulpin	Dr. J. B. Gulpin	do
9053				do		do	do	do
9270				do		do	do	do
9283				Staten, Me.		J. D. Parker	J. D. Parker	do
9704		535		Utah Mountains	Sept. 20, 1873	Dr. F. V. Hayden	H. D. Schmidt	do
9085				Idaho		Dr. Whitehead	Dr. Whitehead	do
3313				Fort Bellingham, Wash. T.		A. Campbell	Dr. C. B. R. Kennerly	do
3990	3080	397		Skagit Valley		do	do	Skin and skull.
5678		417		Washington Territory		do	do	Skin.
		418		do		do	do	do
3649				Fort Creek, Cal.		J. Feilner	J. Feilner	do

TABLE V.—List of specimens examined of SCIUROPTERUS VOLUCELLA var. VOLUCELLA.

Catalogue-number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.	Remarks.
1363				Lake Superior	Summer, 1868.	L. Agassiz	L. Agassiz	Skin	In M. C. Z., Cambridge, Mass.
1967				Upton, Me.	Summer.	J. G. Rich.	J. G. Rich.	do	do.
1171				do	do	do	do	Alcoholic	do.
3056				Norway, Me.	do	Irving Frost	Irving Frost	do	do.
3057				do	do	do	do	do	do.
3058				do	do	do	do	do	do.
3064				do	do	do	do	do	do.
3787				do	do	do	do	do	do.
	943			do	do	do	do	Skull	do.
	948			do	do	do	do	do	do.
	973			do	do	do	do	do	do.
596				do	do	B. D. Verrill	B. D. Verrill	Skin	do.
598				do	do	do	do	do	do.
1185				do	do	A. E. Verrill	A. E. Verrill	do	do.
1033				Milltown, Me.	do	G. A. Boardman	G. A. Boardman	do	do.
3753				do	do	do	do	do	do.
3113			♂	Calaia, Me.	do	do	do	do	do.
	941			Eastport, Me.	do	do	do	Skull	do.
4641				Waterville, Me.	do	C. E. Hamlin	C. E. Hamlin	Skin	do.
4371				Dummer, N. H.	do	John Vosey	John Vosey	do	do.
4378				do	do	do	do	do	do.
4373				do	do	do	do	do	do.
969				Mills, N. H.	do	J. B. Fulsome	J. B. Fulsome	do	do.
1001				Amherst, N. H.	do	W. H. Mallett	W. H. Mallett	do	do.
1378				Hudson, Mass.	do	S. J. Lillan	S. J. Lillan	do	do.
1979				do	do	do	do	do	do.
809				Lynn, Mass.	do	do	do	Alcoholic	do.
3756				do	do	do	do	do	do.
1561				Massachusetts	do	L. Agassiz	L. Agassiz	Skin	do.
1574				do	do	do	do	do	do.
1565				do	do	do	do	do	do.
	976			do	do	do	do	Skull	do.
1468				do. f	do	do	do	Skin	do.
3507				do. f	do	do	do	Alcoholic	do.
3309				do	do	do	do	do	do.
9419	1401			Evansville, Ill.	do	O. Marcy	O. Marcy	do	do.
9480	1402			do	do	do	do	do	do.
3783				Lawn Ridge, Ill.	do	H. Butler	H. Butler	do	do.
998				do	do	do	do	do	do.
793				Burlington, Iowa	do	do	do	do	do.
				Deep River, N. C.	do	W. C. Kerr	W. C. Kerr	do	do.
	9948			Chesler County, Pa.	do	Dr. E. Miekner	Dr. E. Miekner	Skull	In Nat. Mus., Wash., D. C.
	4997			do	do	do	do	do	do.
1010				Washington, D. C.	do	do	do	Skin	do. (Albino.)
4008	?			do	do	C. M. Langdon	C. M. Langdon	do	do. (Albino.)
4097				do	do	J. W. Williams	J. W. Williams	do	do.
4010				do	do	S. F. Baird	S. F. Baird	do	do.
11130	?			Bladenburg, Md.	Aug. 23, '86	Dr. E. Osborn	Dr. E. Osborn	do	do.
88				Racine, Wis.	do	P. R. Hoy	P. R. Hoy	do	do.
3158				Independence, Mo.	do	Dr. J. G. Cooper	Dr. J. G. Cooper	do	do.

TABLE V.—List of specimens examined of *SCIUROPTERUS VOLUCELLA* GRAY. *VOLUCELLA*—Continued.

Catalogue-number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.	Remarks.
786	.....	.....	.....	Columbus, Miss.	.....	Dr. Spillman	Dr. Spillman	Skin	In Nat. Museum.
797	.....	.....	.....	do	.....	do	do	do	do
9839	.....	.....	.....	Prairie Mer Rouge, La.	.....	J. Fairie	J. Fairie	do	do
4915	.....	.....	.....	New Orleans, La.	.....	J. Varden	J. Varden	Alcoholic	do
7361	.....	.....	.....	Grand Coteau, La.	.....	St. Charles College.	.....	do	do

GENUS *SCIURUS* Linnæus.

*Sciurus* LINNÆUS, Syst. Nat. 10th ed. 1758 (in part), and of most subsequent authors.

*Macrozous* F. CUVIER, "Diet. des Sci. Nat. x, 1818"; Mém. du Mus. x, 1825, 132; Mém. des Mam. 1825, 161; Diet. des Sci. Nat. lix, 1899, 474. (Type *Sciurus aestivus* Linn.)

*Macrozous* GRAY, Ann. & Mag. Nat. Hist. 3d ser. xx, 1837, 375. (Not *Macrozous* F. Cuvier.)

*Rhinosciurus* GRAY, Cat. Mam. Brit. Mus. 1843, 195; Ann. & Mag. Nat. Hist. 3d ser. xx, 1837, 395. (Type *Sciurus tapacides* Blyth.)

*Rheithrosciurus* GRAY, Ann. & Mag. Nat. Hist. 3d ser. xx, 1837, 372. (Type *Sciurus macrotis* Gray.)

GENERIC CHARs.—Skull short, very broad, especially interorbitally, and the cranial portion greatly expanded; postorbital processes terminating in a long, slender point, directed posteriorly (and more or less outwardly) and decurved; malar bone slender, the plane of its expansion nearly vertical; anteorbital foramen a narrow vertical slit, opening far in advance of the first premolar; upper grinding-teeth four or five, the first premolar (when two are present) very small; muzzle short, nasals greatly narrowed posteriorly; ears well developed, well clothed, sometimes tufted, especially in winter; tail long, generally as long as or longer than the body, broad, the long hairs spreading laterally; nail of pollex rudimentary; pelage generally full and soft, but sometimes more or less rigid; coloration variable, but never with well-defined black stripes on the dorsum; size generally large; no cheek-pouches, and no lateral membrane connecting the fore and hind limbs.

The true arboreal Squirrels are at once easily distinguishable from the Flying Squirrels by the absence of the membranous expansion along the sides of the body as well as by numerous other very obvious differences. They differ from *Tamias* in the form and position of the anteorbital foramina, the broader and less tapering muzzle; in the greater verticality of the plane of the malar bone; in the greater convexity of the dorsal outline of the skull;

\* See Agassiz, Nomenclator Zoologicus, Mamm. p. 19.

and in pattern of coloration; from the larger, large-eared, long-, broad-tailed *Spermophiles* in the shorter, broader, more expanded form of the skull, its more convex dorsal outline, slenderer and less diverging zygomatic arches, the strict parallelism of the inner edges of the molar series, and the narrower and more anteriorly situated anteorbital foramina, etc.

A division of the American *Sciuri* into other than arbitrary or artificial groups seems almost impossible. Although some of the species have two premolars and others one, some tufted and others tuftless ears; although some are of large size and others small; and although the skull varies in respect to convexity, interorbital breadth, and somewhat in other features, these differences are so variously combined that no sharply dividing lines can be drawn if more than a single character be taken. In respect to the presence and size of the first upper premolar, the species fall into three sections, with which, to some extent, other characters correspond. In some of the species, so far as I can determine, there is but a single premolar at any period of life; in one (*S. hudsonius* and its varieties), a second is generally present, though often disappearing late in life; it is, however, so minute as to easily escape observation, never rising to the level of the other teeth, it being generally merely a slender, minute point situated close to the inner edge of the anterior root of the second premolar, *beneath the front edge of the base of its crown*. Sometimes it is a mere point, and at other times is about one-half the height of the second premolar. In the greater number of the species, two premolars are permanently developed, but the first is often minute, scarcely reaching the height of the second, and is occasionally absent in those species in which, as a rule, it is present.

The pelage varies greatly in character in the different species, being sometimes full, fine, and soft, even among the tropical forms; again, it is short and sparse, and at other times long, coarse, and stiff.

Perhaps the most obviously variable feature is the character of the tail. Generally, its length, measured from the base to the end of the vertebræ, is rather less than the length of the head and body; sometimes these two measurements are equal, while occasionally the tail is a third less than the length of the head and body. The tail, to the end of the hairs, is very generally equal to or longer than the head and body; sometimes much longer, occasionally about equal, and more rarely somewhat less. The tail also varies greatly in fulness and breadth. In *Sciurus fessor* and *S. colliei*, the tail, when fully spread, has a breadth of five or six inches, the hairs of the sides

being two and a half to three inches in length. On the other hand, in *S. hypopyrrhus*, in which the length of the tail is fully as great as in *S. fossor* and *S. colliai*, its breadth is about one-third less. The tail is narrowest (in the long-tailed species) in *S. estuans*, but even in this species it is still distinctly flattened or distichous, except possibly in badly prepared specimens, though not unfrequently cylindrical at the end.

M. F. Cuvier, in 1818, separated the Guerlinguets from the true Squirrels under the name *Macrozus*, referring to this group the *Sciurus astuans* of Brazil and the *Sciurus vittatus* of India. The characters given for this group, as distinguishing it from *Sciurus*, are the greater cerebral-capacity of the skull, the tail not distichous at the point, the nasal portion of the skull separated from the cranial by a strong depression, and by the large size of the testes.\* Although *Macrozus* was adopted by Lesson in 1827, it has been by most writers properly ignored, the characters given having little value. The *Macrozus* of Gray (1867), although including the species referred to *Macrozus* by Cuvier, is based on a wholly different feature, namely, on the absence of ear-tufts, and hence embraces all the *Sciuri* with untufted ears. *Sciurus*, as left by Gray, thus includes only a few species with conspicuously tufted ears, like *S. vulgaris* and *S. aberti*. This distinction, it is almost needless to say, is not of the slightest importance as a generic character, the long ear-tufts being merely a seasonal feature, if not in part, in some species at least, simply individual. In the North American *S. aberti*, individuals are found both with and without them at the same localities and seasons, while in other individuals they may be found of different degrees of development. Many other species have the ears slightly tufted in winter, which are wholly without ear-tufts in summer.

The American *Sciuri* reach their greatest numerical development in Middle America; Southern Mexico and Central America being far richer in species than any other region in either North or South America of similar area. The species are here remarkable also for their extreme variability in color. Melanistic phases of coloration are frequent, while all the species are normally fulvous, orange, or red below, white-bellied specimens from this region being exceptional; with perhaps a single exception, none of the specific

\* The diagnosis given by Cuvier of "les Guerlinguets" (*Macrozus*) is as follows:—"Ce sont des écureuils dont la queue n'est point distinguée et dont la capacité cérébrale surpasse de beaucoup celle des écureuils proprement dits et celle des tamias. Une dépression très-marquée sépare le crâne d'un museau peu allongé. Enfin, ils sont remarquables par leurs testicules volumineux."—(*Dict. Sci. Nat.*, II, 1820, 474.)

or subspecific forms are permanently white below. The large number of synonyms that have arisen in consequence of this variability in color, together with the variability itself, render the recognition and characterization of the species exceedingly difficult. The abundance of the material accessible for the study of the species occurring north of Mexico renders this part of the work comparatively easy, and demonstrates clearly the large amount of both individual and geographical variation one must be prepared to recognize, frequently at least, in the different specific representatives of this perplexing group. Some of the Mexican species seem to be fully as variable in coloration as any that are met with in the United States, so that color alone becomes a wholly unsafe guide for the determination of the species. On the other hand, *Sciurus fessor*, of the west coast of the United States, is as constant in its coloration as any Mammal with which I am acquainted, and the Brazilian form of *Sciurus aestuans*, although widely distributed, presents only a small range of variation in either color or size. The large Squirrel of Western Brazil and the neighboring region to the westward (*S. variabilis*), though subject to considerable variation in color, is far less variable than some of the Mexican and North American ones. Three, at least, of the Central American forms also vary less than many of the others: these are *Sciurus gerrardi*, *S. tephrogaster*, and *S. aestuans* var. *rufoniger*, which range southward into the northern States of South America.

The material at my command, though large in amount (probably considerably exceeding that ever before collectively examined by any previous investigator), is quite insufficient for a satisfactory study of the tropical forms, and the results arrived at are considered as open to future revision. Among the numerous (some thirty or more) nominal species of authors, I have been able to recognize only nine or ten that seem to me valid, with two additional subspecies. These latter may possibly be entitled to specific rank, but I think that, on the whole, the number of species will, by future investigation, be still further reduced, rather than increased, and that I have erred in recognizing too many species rather than too few. In the majority of instances, I have been able to make the collocation of the nominal species with a good degree of confidence; in other cases, of course, only with much doubt; while two or three names I have been wholly unable to identify. One is doubtfully American, and one or two I have provisionally adopted as possibly valid species are yet unknown to me from specimens.

In regard to the geographical distribution of the species, it is worthy

of note that the smallest species (*Sciurus hudsonius*) is the most northern, and that the next smallest (*Sciurus aestuans*) is the most southern, both occurring on the extreme boundaries of the habitat of the group. These again, in respect to the development of the tail, are the least Sciurine; the long, full, bushy, distichous tail, so characteristic a feature of the *Sciuri* as distinguishing them from their allies, being in these two species very much shorter and narrower than in any of the others. In passing southward, we meet, next after *S. hudsonius*, with *S. carolinensis*, a species again below the average in size, with the tail only moderately developed, although there are some Mexican and Central American species equally small. The largest species, as well as the greatest number, and those with the largest tails, are Mexican; Western and Southern Mexico being apparently the centre of development, or metropolis of the group, as respects the two Americas. None are thus far known from any of the intertropical islands.

As already observed, the American *Sciuri* form a group so homogeneous as not to be readily subdivisible. Taking, however, the relative length of the tail, and the number and character of the upper premolars, as a basis, with such other features as are most readily available, the species and subspecies may be conveniently (and somewhat naturally) grouped as follows:—

#### SYNOPSIS OF THE SPECIES AND SUBSPECIES OF AMERICAN SCIURI.

- I. Tail very short and narrow, the caudal vertebrae alone about two-thirds as long as the head and body; tail to end of hairs about one-seventh shorter than the head and body; premolars  $\frac{1}{2}$ , the first very small and often deciduous; a narrow, black, lateral line; size small. One species with four subspecies:
  1. Above grayish, mixed with yellowish or reddish, annulated with dusky, often with a strong wash of ferruginous along the middle of the back; below generally white, sometimes narrowly annulated with black; in one subspecies fulvous below. *Hab.*—Northern half of North America..... *S. HUDSONIUS*.
  - a. Above yellowish-gray, varied with black, with generally the middle of the back strongly washed with ferruginous; upper surface of the tail with the hairs rusty at the base and reddish-tipped, with a broad subterminal bar of black. *Hab.*—Northern North America east of the Rocky Mountains and northward to Alaska..... *var. hudsonius*.
  - b. Above varied with black and yellowish-rusty; upper surface of the tail with the hairs gray at the base and gray-tipped, with a broad subterminal bar of black. *Hab.*—Central portion of the Rocky Mountains, and thence westward to the Sierra Nevada..... *var. fremonti*.
  - c. Above dusky, strongly varied with reddish; upper surface of the tail with the hairs dark reddish-brown at the base, tipped with reddish, and with a very broad subterminal bar of black, sometimes occupying the whole of the terminal third. *Hab.*—Rocky Mountains between latitude  $43^{\circ}$  and  $59^{\circ}$ , and thence westward to the Cascade Range..... *var. richardsoni*.
  - d. Above as in the preceding (*var. richardsoni*); tail with less black; beneath more or less strongly tinged with fulvous or rufous. *Hab.*—Pacific-coast region from Northern California to Sitka..... *var. douglasii*.



II. Tail-vertebrae about four-fifths (five-sixths to three-fourths) the length of the head and body; tail, with the hairs, rather longer than the body (in most of the species one-twelfth longer), generally full and bushy. Premolars usually  $\frac{1}{2}$ ; in a few species  $\frac{1}{3}$ . Size large or medium:

A. Premolars  $\frac{1}{2}$ :

2. Above whitish-gray, varied (except in one subspecies) with fulvous; beneath white; middle of back more or less brownish; an indistinct fulvous lateral line; ears never conspicuously tufted. *Hab.*—Southern parts of Canada, the United States east of the Plains, and southward to Southern Mexico and Guatemala ..... *S. CAROLINENSIS*.
- a. Above whitish-gray, with generally a small, narrow, brownish area along the middle of the back; length from nose to tail 10.00 inches or more; runs frequently into melanistic phases, which are sometimes wholly black. *Hab.*—United States and Southern Canada southward to the Louisianian fauna ..... *var. leucotis*.
- b. Smaller; generally less than 10.00 inches in length; greater part of dorsal surface brownish, sides only whitish-gray; rarely runs into melanistic phases. *Hab.*—South Atlantic and Gulf States and southward ..... *var. carolinensis*.
- c. Still smaller; plain dull-gray, unvaried with fulvous; middle of the back darker. *Hab.*—Yucatan ..... *var. yucatanensis*.
3. Above dark bluish-gray; a dorsal band of bright chestnut; a distinct black lateral line; no fulvous suffusion; below white; ears very large, each with a conspicuous tuft or pencil of long hairs, as in *S. vulgaris*; runs into melanistic phases. *Hab.*—Rocky Mountains of Colorado, southward into Arizona ..... *S. ARIZONI*.
4. Above dark brown, varied with yellowish-gray, or black, varied with fulvous; beneath deep brownish-red; color very variable. *Hab.*—Southern Mexico and Central America ..... *S. BOOTHII*.
5. Above gray, varying from whitish to dark iron-gray, generally with a large patch of yellowish-rusty on the nape and lower part of the back; beneath pure white, yellowish-white, or deep golden-yellow; pelage generally ringed with bright fulvous beneath the surface; tail rather narrow; very variable in coloration. *Hab.*—Southern Mexico ..... *S. LEUCOPS*.
6. Above dark gray, varying from whitish-gray to dusky iron-gray; beneath deep reddish-orange, invading irregularly the gray of the sides, the red wash of the sides sometimes nearly meeting on the dorsal line at the shoulders; pelage soft and full; tail bushy. *Hab.*—Southern Mexico and Guatemala ..... *S. AUREOGASTER*.
7. Above dark olivaceous-brown, minutely varied with yellowish or rufous; beneath gray varying to rufous; tail rather narrow; length about 9.75; tail with the hairs about the same or a little less; size and general appearance of *S. astutus* var. *rufosiger*, but with two upper premolars instead of one; smaller than either of the preceding, with narrower and shorter tail. *Hab.*—Southern Mexico, Central America, and northern portions of South America ..... *S. TEPHROGASTER*.

B. Premolars  $\frac{1}{3}$ :

8. Color above generally some shade of gray, but extremely variable; rusty and melanistic phases very prevalent; size large; tail broad and bushy. Runs into three subspecies. *Hab.*—Eastern United States westward to the Plains ..... *S. NIGER*.
- a. Length about 13.00 inches; color variable, but with the nose and ears white, contrasting with the color of the rest of the dorsal surface; generally whitish-gray above, running into rufous; below generally fulvous or rufous; dusky phases frequent. *Hab.*—South Atlantic and Gulf States ..... *var. niger*.
- b. Smaller; length generally less than 13.00 inches; similar in color to *var. niger*, but with the nose and ears not white, in contrast with the rest of the dorsal surface. *Hab.*—Northern Atlantic States from Virginia to New England ..... *var. macrurus*.
- c. Size of the last; less variable in color; above dusky-gray, strongly suffused with rufous; ears, feet, and ventral surface fulvous, varying to rufous; occasionally dusky or black beneath. *Hab.*—Whole of the Mississippi Basin, extending westward to the Plains and northward into Dakota ..... *var. induratus*.



9. Middle of the dorsal region dusky or black; rest of dorsal surface varied with dusky and yellowish-rufous; beneath dark reddish-brown, varying to fiery-orange; length about 9.50 inches; tail full and bushy, rather longer than head and body. *Hab.*—Southern portion of Central America and the northern portion of South America... *S. GERRARDI*.
10. Size rather small; length about 8.00 to 9.00 inches; above dark olivaceous-brown, minutely varied with yellowish or rufous; beneath fulvous or rufous; tail rather narrow, occasionally decidedly cylindrical toward the end. *Hab.*—Brazil, Northern South America, and Central America. Runs into two well-marked subspecies... *S. ESTUANS*.
- a. Length about 8.00 inches; tail edged with pale yellowish; smaller and less rufous than the next. *Hab.*—Brazil and Guiana... *var. castaneus*.
- b. Length about 9.00 inches; tail edged with red, varying in tint from light yellowish-red to dark cherry-red; general color above rather more rufous than in *var. castaneus*; also rather redder below. *Hab.*—Northern South America and Central America... *var. rufoniger*.
- III. Tail-vertebrae alone equal to the length of the head and body; tail with the hairs one-seventh to one-fourth longer; size large; premolars 4:
- A. Tail full, bushy:
11. Above dark pure-gray; beneath white; tail black, washed with white. *Hab.*—Pacific coast from the Columbia River southward to San Diego, Lower California; not east of the Coast Ranges... *S. FOSSOR*.
12. Above clear gray, except the middle of the dorsal region, where the color is mixed yellowish-brown and black; beneath generally white, varying at some localities to yellowish-fulvous or rufous. *Hab.*—Mexico... *S. COLLIERI*.
13. Above black, varied with ochre-yellow and rufous; beneath white, fulvous- or brownish-red; tail black at base and centrally below, edged broadly with red or yellowish-red, appearing mainly of this color at the surface; pelage short and sparse, especially below. *Hab.*—Western Brazil, and thence westward to the eastern base of the Andes, and from Bolivia northward to New Grenada... *S. VARIABILIS*.
- B. Tail narrow; pelage coarse and rigid:
14. Color variable, running into both albinistic and melanistic phases; generally more or less black above, varied with fulvous and red beneath. *Hab.*—Southern Mexico and Central America... *S. HYPOPYRRHUS*.

## I.—Species inhabiting North America north of Mexico.

## SCIURUS HUDSONIUS Pallas.

## Chickaree.

## Var. HUDSONIUS.

## Eastern Chickaree.

*Sciurus vulgaris* FORSTER, Phil. Trans. lxi, 1772, 378.

*Sciurus vulgaris*, n. *hudsonius* ERDMAN, Syst. Anim. 1777, 416.

*Sciurus hudsonius* PALLAS, Nov. Spec. Glir. 1778, 376.—GMELIN, Syst. Nat. i, 1788, 147.—SCHREBER, Säugeth. iv, 1792, 777, pl. ccxiv.—BROWN, Gen. Zool. ii, 1801, 140.—KUNZ, Beiträge zur Zool. 1820, 66.—DESMAREST, Mammal. ii, 1822, 340.—BABINE, Franklin's Narr. 1823, 663.—HALL, FUND. AMER. 1825, 183.—GODMAN, Am. Nat. Hist. ii, 1896, 139.—RICHARDSON, Fauna Boreali-Am. i, 1899, 187, pl. xvii.—FISCHER, Synop. Mam. 1839, 349.—GAPPER, Zool. Jour. v, 1830, 205.—F. CUVIER, Suppl. Buff. Hist. Nat. i, Mam. 1831, 303.—BACHMAN, Proc. Zool. Soc. Lond. vi, 1838, 100; Charlesworth's Mag. N. H. iii, 1839, 383.—THOMPSON, Nat. Hist. Vermont, 1849, 46; App. 1853, 14 (albino).—DEKAY, New York Zool. i, 1843, 61, pl. xvii, fig. 2.—WAGNER, Suppl. Schreber's Säugeth. iii, 1843, 178.—SCHINZ, Synop. Mam. ii, 1845, 19.—AUDUBON & BACHMAN, Quad. N. Am. i, 1849, 125, pl. xiv.—WOODHOUSE, Sitgreaves's Expl. Colorado and Zuni Rivers, 1853, 53 (Indian Territory).—KENNICOTT, Pat. Off. Rep., Agr. 1876, (1867), 67, pl. vii.—BAIRD, Mam. N. Am. 1877, 260, pl. xvi, fig. 1.—THOMAS, Trans. Ill. Stat.

- Agric. Soc. iv, 1860, 656.—HALL, Canad. Nat. and Geol. 1861, 290.—MAXIMILIAN, Wiegmann. Arch. f. Naturg. 1861, 73.—ROSS, New Edinb. Phil. Journ. xiii, 1861, 162; Nat. Hist. Rev. 1863, 274 (to Arctic Circle).—GRAY, Ann. and Mag. Nat. Hist. 3d ser. xx, 1867, 418.—ALLEN, Bull. Mus. Comp. Zool. i, 1869, 293; Proc. Bost. Soc. Nat. Hist. xiii, 1870, 188; ib. xvii, 1874, 43, Bull. Essex Inst. vi, 1874, 57.—GILPIN, Proc. and Trans. Nova Scot. Inst. Nat. Sci. ii, pt. iii, 1870, 12.—STEVENSON, Hayden's Rep. U. S. Geol. Survey Wyom. 1871, 461.—ADAMS, Field and Forest Rambles, 1873, 98, 295.—MERRIAM, U. S. Geolog. Surv. Terr. 6th Ann. Rep. 1873, 663.—GRINNELL, Ludlow's Black Hills of Dakota, 1874, 81.
- Sciurus hudsonius* var. *hudsonius* ALLEN, Proc. Bost. Soc. Nat. Hist. xvi, 1874, 263.
- Sciurus carolinus* ORD—"Guthrie's Geog. (3d Am. ed.) ii, 1815, 292."
- Sciurus rubrolineatus* DERMAREST, Mam. ii, 1822, 333.
- Tamias hudsonia* LESSON, Man. Mamm. 1827, 231.
- Tamias rubrolineatus* SCHINZ, Syn. Mam. ii, 1843, 48.
- Esquival d'Hudson*, F. COVIER, Hist. des Mam. livr. xivi, 1821.

## VAR. RICHARDSONI.

## Richardson's Chickaree.

- Sciurus richardsoni* BACHMAN, Proc. Zool. Soc. Lond. vi, 1838, 160; Charlesworth's Mag. Nat. Hist. iii, 1839, 389; Journ. Acad. Nat. Sci. Phila. viii, 1839, 64; Townsend's Narrative, 1839, 318.—AUDUBON & BACHMAN, Quad. N. Am. i, 1849, 41, pl. v.—BAIRD, Mam. N. Am. 1857, 273.—COOPER, Nat. Hist. Wash. Terr. pt. iii, 1860, 79.—BUCKLEY, ibid. 97, 191.—STEVENSON, Hayden's Rep. U. S. Geol. Surv. Wyom. 1871, 461.
- Sciurus hudsonius* var. *richardsoni* ALLEN, Proc. Bost. Soc. Nat. Hist. xvii, 1874, 266.

## VAR. DOUGLASSI.

## Western Chickaree.

- Sciurus hudsonius*, var. *β*, RICHARDSON, Fann. Bor.-Am. i, 1839, 190.
- Sciurus hudsonius* RICHARDSON, Zool. Beechey's Voy. Mam. 1839, 6 (banks of the Columbia).
- Sciurus douglasi* GRAY, Proc. Zool. Soc. Lond. iv, 1836, 86 (no description).—BACHMAN, Proc. Zool. Soc. Lond. vi, 1838, 99; Journ. Acad. Nat. Sci. Phila. viii, 1839, 63; Charlesworth's Mag. Nat. Hist. iii, 1839, 363; Townsend's Narrative, 1839, 317.—WAGNER, Suppl. Schreber's Säuget. iii, 1843, 177.—SCHINZ, Syn. Mam. ii, 1845, 10.—AUDUBON & BACHMAN, Quad. N. Am. i, 1849, 370, pt. xiviii.—BAIRD, Mam. N. Am. 1857, 275.—COOPER, Nat. Hist. Wash. Terr. pt. iii, 1860, 79.—BUCKLEY, Nat. Hist. Wash. Terr. pt. iii, 1860, 97, 191.—GRAY, Ann. and Mag. Nat. Hist. 3d ser. xx, 1867, 418.—HENSLEY, Ann. Rep. Chf. Engineers for 1876, App. ii (1876), 310.
- Sciurus hudsonius* var. *douglasi* ALLEN, Proc. Bost. Soc. Nat. Hist. xvii, 1874, 268.
- Sciurus townsendi* BACHMAN, Journ. Acad. Nat. Sci. Phila. viii, 1839, 63 (MS. name).
- Sciurus tawagious* BACHMAN, Proc. Zool. Soc. Lond. vi, 1838, 101 (partial albino); Charlesworth's Mag. Nat. Hist. iii, 1839, 387; Journ. Acad. Nat. Sci. Phila. viii, 1839, 64; Townsend's Narrative, 1839, 320.—WAGNER, Schreber's Säuget. iii, 1843, 180.—SCHINZ, Synop. Mam. ii, 1845, 11.—AUDUBON & BACHMAN, Quad. N. Am. i, 1849, 190, pl. xev.
- Sciurus molliglossus* AUDUBON & BACHMAN, Proc. Acad. Nat. Sci. Phila. i, 1849, 103; Journ. Acad. Nat. Sci. Phila. viii, 1849, 316; Quad. N. Am. i, 1849, 157, pl. xix.
- Sciurus talpoides* GRAY, Ann. and Mag. Nat. Hist. x, 1842, 963; Zool. of the Sulphur, 1844, 23, pl. xii, fig. 9 (mountain of the Columbia).
- Sciurus ocellatus* BAIRD, Proc. Acad. Nat. Sci. Phila. vii, 1855, 339; Mam. N. Amer. 1857, 270 (foot-note).
- Small Brown Squirrel*, LEWIS & CLARK, Exped. ii, 1814, 174.
- Small Gray Squirrel*, LEWIS & CLARK, ibid. 175.

## VAR. FREMONTI.

## Fremont's Chickaree.

- Sciurus fremonti* AUDUBON & BACHMAN, Quad. N. Am. iii, 1853, 237, cvlix, fig. 1.—BAIRD, Mam. N. Am. 1857, 273.
- Sciurus douglasi* var. *fremonti* GRAY, Ann. and Mag. Nat. Hist. 3d ser. xx, 1867, 419.
- Sciurus hudsonius* var. *fremonti* ALLEN, Proc. Bost. Soc. Nat. Hist. xvii, 1874, 269; Bull. Essex Inst. vi, 1874, 63.—COOPER & YARROW, Whistler's Expl. and Surv. West of 100th Merid. v, Zoology, 1870, 117.

## Var. HUDSONIUS.

*Eastern Chickaree.*

Average length from the end of the nose to the base of the tail 6.75 (for New England specimens); tail, to end of vertebræ, 4.50; tail, to end of hairs, about 6.00. Above, pale grayish-fulvous, each hair narrowly once or twice ringed with black; below, pure white, or white with faint annulations of black. Generally, the middle of the back is red, this color forming a broad mesial band, extending from the front of the head continuously to the end of the vertebræ of the tail. In many specimens, there is a short, conspicuous, black, lateral line. The ears are blackish toward and at the end, and have, in winter, a short, bushy pencil, or tuft. The upper surface of the feet is generally more or less tawny, often bright golden, but sometimes is of the same tint as the sides of the body. The tail above is centrally of the same color as the back, bordered with a conspicuous, broad bar of black, and edged and tipped with yellowish; below, yellowish-gray.

Different specimens from the same locality vary greatly in color irrespective of season or sex. A small proportion of the specimens have a conspicuous black lateral line separating the white of the lower surface from the gray of the upper surface. Generally, not more than one specimen in ten is thus marked, and such specimens are found, on careful examination, to be in summer pelage. Yet only a small proportion of those in summer pelage are thus marked, while I have never met with it in any specimen in winter pelage. Many of those thus marked are evidently the young of the year, and I am hence led to believe that it is a temporary feature of coloration characteristic of animals less than a year old, and that it permanently disappears with the first autumnal moult. I find, however, two specimens with a distinct lateral line that are adult females. The same mark occurs in the other varieties of this species, but it is often absent in those in winter pelage. Its more frequent presence in specimens of the western forms is easily explainable, in part at least, from nearly all having been collected in summer.

The red mesial band of the dorsal surface varies greatly in tint and in breadth, being sometimes merely a narrow line, and again occupying more than one-third of the dorsal surface. The color of this band varies from light yellowish-red to dark cherry-red. The hairs of the middle portion of the band are generally wholly red to the ends; at other times, they are all

distinctly ringed with black. Young specimens having the black lateral line wholly lack the red dorsal stripe, or have it only faintly indicated. In autumnal specimens, the black lateral line is faintly indicated, and the middle of the back has the dorsal stripe obscurely defined. Winter specimens, as a rule, are decidedly redder than summer specimens. Examples from the same locality, collected at the same season, vary greatly in respect to the tint of the red dorsal band, as well as in respect to its extent. No. 1484 (Coll. M. C. Z.), a winter specimen from Maine, has the dorsal band very broad and of a light yellowish-red; this specimen is one of the lightest of the whole series. Others, however, are scarcely darker, imperceptibly grading into No. 2491 (Coll. M. C. Z.), also from Maine (but taken in November), in which the dorsal stripe is dark red, annulated with black, the red being nearly as dark as in the lighter phases of var. *richardsoni*.

The lower surface is generally pure white, with the hairs dusky at the base; sometimes grayish-white, in consequence, in part, of the duskiness of the base of the hairs being only partly hidden by the white tips, and in part from the white tips of the hairs being annulated with black. In a large proportion of the specimens, the hairs of the lower surface are in part annulated near the tips with black; in some specimens, nearly all are so annulated, giving a distinctly grayish aspect to the ventral surface; in many others, a close inspection is necessary in order to discover any that are annulated; not a few are absolutely without dusky annulations. Summer specimens with a black lateral line have the ventral surface intensely white, the white extending nearly to the base of the hairs. The dusky annulations are more developed in northern specimens than in southern; but Massachusetts specimens frequently present them. They are more common in specimens from Maine, while in specimens from Nova Scotia, Labrador, and the Fur Countries these dusky annulations form a conspicuous feature of the coloration.

As already noted, the color of the feet varies from pale fulvous-gray to rusty-golden. The general color of the dorsal surface (including the upper surface of the tail) varies from quite pure gray to pale fulvous, annulated with black. The ears are generally dusky or blackish on the dorsal surface, washed with fulvous or rufous; in winter, bushy-haired and penciled; in summer, covered merely with short hairs.

In summer, the soles of the feet are naked, often wholly so to the heel; in winter, they are wholly thickly furred, only the tubercles at the base of

the toes being naked. The general pelage is also much fuller, longer, and softer in winter than in summer.

The skull presents the usual range of individual variation so often noted in these papers, especially in respect to the form of the nasal bones. These vary greatly in width, especially posteriorly, and also in respect to length. In skulls of the same general size, the width of the nasals posteriorly varies from 0.10 to 0.15 of an inch, or nearly 33 per cent. of the average width. They also vary greatly in respect to their posterior outlines, being generally more or less emarginate, but vary from squarely truncate to deeply emarginate. As already noted in the general remarks upon the genus *Sciurus*, the first premolar is generally present, though often so minute as to readily escape detection. I find it more frequently present in New England specimens than in those from Fort Simpson, H. B. T. In the former, it is to be found in about two specimens out of three; in the latter, in only about one in six! It is also pretty uniformly present in Pennsylvania specimens.

As shown by the subjoined tables of measurements, northern specimens are considerably larger than southern ones. Specimens from Minnesota, and thence westward to the Black Hills, appear to be larger than those from the Fur Countries, as often happens in other species of North American Mammals. On the other hand, Pennsylvania specimens are larger than those from Massachusetts, New Hampshire, and Maine. Taking the skulls as a basis for comparison, twelve skulls from Upton, Me., have an average length of 1.73, while ten skulls from Greensburg, Pa., average 1.80. Ten others from Fort Simpson, H. B. T., average very nearly 1.85, or 0.12 (about one-seventh) more than those from Maine. The length of fully adult specimens from Maine and New Hampshire (measured from the end of the nose to the base of the tail) rarely exceeds 6.75, and very often falls below 6.50; Massachusetts specimens frequently exceed 7.00, and not often fall below 6.75 while Pennsylvania specimens are still larger. Specimens from the Fur Countries are still larger, apparently averaging 7.75.

In respect to other geographical variations, specimens from high northern localities are paler and more fulvous than those from the United States, and are more annulated beneath with black. The brightest or reddest specimens in the collection are from New York, Pennsylvania, and Ohio, in which, also, annulations below are infrequent. New England specimens are scarcely different in color from those from the Middle States; Maine specimens being,

on the whole, rather more distinctly annulated with black below. Nova Scotia and Labrador specimens, as well as those from the different posts of the Hudson's Bay Company and Alaska, have the hairs of the ventral surface very strongly annulated, and the dorsal band narrower and paler, often inclining strongly to fulvous. Specimens from the Upper Missouri, Yellowstone, and Black Hills are paler, and hence more fulvous, than those from east of the Mississippi.

Var. RICHARDSONI.

*Richardson's Chickaree.*

VARIETAL CHARS.—Length, from end of nose to base of tail, about 7.50; tail to end of vertebræ about 5.90; to end of hairs 7.60. Above pale yellowish-gray; middle of the back dark brownish-red; beneath white, more or less distinctly annulated with black, as in northern examples of var. *hudsonius*. Generally, the gray of the dorsal surface is separated from the white of the ventral surface by a conspicuous black line. Tail centrally above like the middle of the back, with a broad subterminal bar of intense black faintly washed with yellowish-gray; often the terminal third is wholly black externally; beneath, the tail is centrally reddish-gray, bordered with black faintly washed with yellowish-gray. Ears black at the tip, bushy-tufted. Feet generally of the same gray tint as the sides of the body, but sometimes reddish.

The general color above varies from yellowish-brown to dark reddish-chestnut, with annulations of black. The rufous of the dorsal surface is generally strongest along the mesial line, where it frequently forms a broad dorsal band, which gradually passes into the color of the sides of the back. The black lateral line is generally well marked, often very prominent, even in winter specimens, but is occasionally wholly obsolete. The hairs of the tail are generally dark chestnut-red at the base, with a broad subterminal bar of black, and are tipped with yellowish-white. In some of the specimens, as those from Saint Mary's, Rocky Mountains, the tail is almost wholly jet-black; generally the hairs are reddish, often dark reddish-chestnut at the base, with pale yellowish-gray tips.

This variety appears to reach its extreme phase of development in the vicinity of Saint Mary's and the Bitter Root Valley in the Rocky Mountains. Specimens from about Fort Benton and the eastern base of the Rocky Mountains in Montana and Northern Wyoming are less strongly marked, but generally incline more to this variety than to var. *fremonti* or than to *hud-*

*sonius* proper. Two specimens, however, from Chief Mountain Lake, forty-ninth parallel, nearly typically represent this variety. On the other hand, specimens from the Cascade Range and thence westward merge gradually into var. *douglasi*, differing mainly from the latter in being white below instead of fulvous.

Var. DOUGLASSI.

*Western Chickaree.*

VARIETAL CHARs.—Length to base of tail 7.50; tail-vertebræ 4.75; tail to end of hairs 6.75. Above fuscous, minutely varied with pale rufous and black, the middle of the back more or less dark rufescent. Beneath varying from white through pale fulvous to bright tawny and buffy-orange; at the northward, much annulated with black, as in var. *hudsonius*. In winter specimens, the ears are conspicuously tufted with black. A prominent black lateral line, especially in summer specimens. Tail gray, fulvous or rufous centrally, with a broad subterminal bar of black, and a broad edging of pure white, gray, or fulvous.

The specimens in the collection vary considerably in respect to the color of the dorsal surface, and still more so in respect to that of the ventral surface. The general color of the upper surface is fuscous yellowish-brown, minutely varied with black, with the middle of the back generally more or less strongly dark reddish-brown, forming sometimes a well defined dorsal band, as in var. *richardsoni*. Often the middle of the back is not perceptibly more rufous than the sides, and, when it is so, the color of the middle of the back generally fades gradually into the general color. Specimens from the same locality vary greatly in tint, both above and below. Thus, the Fort Crook specimens vary in the tint of the middle of the back from dark chestnut-brown to reddish-yellow, and in the general color above from fuscous reddish-brown to clear gray, faintly tinged with fulvous. The lower surface in the same specimens varies from pure white to gamboge-yellow. The tail varies in color to a similar degree, in some being centrally gray above, with a subterminal broad bar of black and a white border; while in others the gray is replaced by fulvous-gray, or even by dark rufous.

The Fort Steilacoom specimens are equally variable, and also differ quite appreciably in the average from the Fort Crook specimens. No. 1968 has the dorsal surface, including the tail, exactly as in a common dark phase



of var. *hudsonius*,—for instance, like No. 2043, from Mount Joy, Pa., and quite a number of others from New York, Massachusetts, and Maine. The lower surface, however, is rich buff. Other specimens are somewhat similar, differing in being darker above and paler below. Specimens from Puget's Sound are profusely annulated below with black, while this feature is absent in California specimens. The tail differs as widely in different specimens as it does in typical examples respectively of varieties *hudsonius* and *fremonti*, in some examples being gray and black, edged with white, in others deep rufous and black, edged with pale yellow. As will be further noticed under var. *fremonti*, some of the Fort Crook specimens are almost exactly like Colorado examples of *fremonti*, while others are intermediate between these and the usual southern phase of var. *douglassi*.

In respect to the dorsal surface, varieties *douglassi* and *richardsoni* are often indistinguishable, the fulvous color of the lower surface in *douglassi* being the only feature that serves to separate them. No. 8777, from the Lower Kwichpak, is exactly intermediate between them, while other specimens still further show a gradual intergradation. Var. *douglassi* is merely var. *richardsoni* with the under parts tawny instead of white. This varies, as already noted, in specimens taken at the same locality and season, from pale buffy-gray to bright reddish-tawny or orange. In other specimens, the tawny is reduced to the faintest shade of fulvous, or is wholly replaced by pure white. The median dorsal band is sometimes wholly absent, though generally faintly traceable, and at other times is strongly developed. The color of the tail varies with the intensity of the tawny of the lower surface of the body. In those with a pale shade of tawny below, the hairs of the tail are yellowish-gray at the base and tipped with white. In those otter-yellow below, the tail-hairs are strongly yellowish at base and tipped with yellowish-white. The light ring surrounding the eye similarly varies from yellowish-white to tawny.

In winter, the pelage is much softer and fuller than in summer; the ears are then tufted, and the soles densely furred. In summer, the ears are generally tuftless, and the soles are more or less naked.

Var. FREMONTI.

*Fremont's Chickarees.*

VARIETAL CHAR.—Length of head and body 7.75; tail to end of vertebrae 4.75; tail to end of hairs 6.50. Above dusky yellowish-gray; beneath pure white



or grayish-white, rarely with faint annulations of black. In summer specimens, there is generally a more or less distinct black lateral line; in many, it is, however, nearly obsolete, and is sometimes wholly absent, as it appears to be generally in winter specimens. The tail is black, edged with gray; the terminal third, however, often wholly black. The tail-hairs are at the base generally gray, but sometimes more or less fulvous, and even rufous.

In this variety, the middle of the back is not generally redder than the rest of the dorsal surface; the reddish dorsal band, so characteristic of the other varieties, being absent. The general color above is hence nearly uniform gray, more or less strongly tinged with yellowish- or reddish-brown. The tail generally has also no fulvous or rufous at the base of the hairs, which are gray at base and tipped with whitish. These are the two principal features of distinction between the present variety and vars. *richardsoni* and *douglasi*. Specimens, however, from various localities, have more or less red or fulvous at the base of the tail-hairs, and, in some specimens, the tail is washed with pale yellowish instead of white. In the extreme phase of this species, the tail is centrally above pure light gray, sometimes tinged slightly with yellowish or rufous. No. 11679, from Fort Garland, Colo., has the tail centrally reddish-yellow to the end of the vertebrae, and edged with pale yellowish-white. The general color varies from pale fulvous, varied minutely with black, to strong yellowish-rufous. The sides are usually paler than the back, but there is never a well defined dorsal band. The feet and outer side of the limbs are frequently golden.

Var. *fremonti* ranges from the eastern base of the middle portion of the Rocky Mountains to the Pacific (some of the specimens from Fort Crook, Cal., being undistinguishable from Colorado ones) and from New Mexico to Southern Montana and Idaho. Specimens from Bear Creek, Oregon, and from the Uintah Mountains are typically of this variety; Fort Bridger specimens are nearly so. Farther northward, it passes into var. *richardsoni*, and in California merges imperceptibly into var. *douglasi*. Several of the California specimens (Nos 3848 and 3846, from Fort Crook) have the under parts pure white, the tail centrally gray and washed with white, and the upper surface uniformly colored; hence closely resembling var. *fremonti*. Others (Nos. 3316 and 4664), from the same locality, are strongly fulvous beneath, like some (No. 1160, for example) of the specimens from the Upper Des Chutes Valley, and even more strongly so than Nos. 1956 and 1420,

respectively from Forts Steilacoom and Vancouver, which unquestionably represent var. *douglasi*. No. 4665 (from Fort Crook) is less fulvous than Nos. 3316 and 4664, while in No. 3847 this tint is barely traceable, thus forming the passage to Nos. 3848 and 3846, which are wholly white below. In No. 3847, the dorsal surface is quite strongly red, especially mesially, this tint being continued into the tail; but the lower parts show no trace of fulvous. Other specimens have the middle of the back faintly rufous. In these specimens, the pelage is fine and soft, and the gray of the upper surface is generally less fulvous than in Colorado specimens.

Specimens from the Wind River Mountain region of Northwestern Wyoming present a peculiar combination of the characters of the three varieties (*fremonti*, *hudsonius*, and *richardsoni*) whose habitats there meet, very few of the specimens typically representing either variety, while not a few of them are almost as well referable to one variety as to the other. As already noticed, in the region of the Black Hills var. *hudsonius* loses much of its redness; the dorsal band becomes less distinct; the middle of the tail is paler; and the edging of the tail is yellowish-gray, instead of bright fulvous, or yellowish-red, as is the case in eastern specimens. In specimens from the sources of the Yellowstone River, particularly in those from the head of the Gros Ventres Fork, the Geyser region of the Yellowstone, etc., we have generally a strong approach to var. *richardsoni*, combined with some of the features of *hudsonius*, as the indistinct darkening of the middle of the dorsal region, the increase of black in the tail, and a deepening of the rufous of the base of the tail-hairs to dull reddish-chestnut. In other specimens, the dorsal surface is like the dorsal surface in var. *fremonti*, with the tail presenting a combination of the characters of vars. *richardsoni* and *hudsonius*. No. 9823, from Yellowstone Lake, has the dorsal surface as in Black Hills specimens of var. *hudsonius*, and also as in very fulvous specimens of var. *fremonti*, while the rufous of the tail is that of var. *richardsoni*, but accompanied with much less black than is seen in typical examples of the latter. Other specimens have the color of the dorsal surface exactly as in average specimens of var. *fremonti*, with the characters of the tail variously intermediate between vars. *hudsonius* and *richardsoni*, perhaps on the whole more resembling *hudsonius*. Wind River Valley specimens are much more reddish above, with a tendency to a well defined dorsal band, while in some there is scarcely more black in the tail than in average examples of var. *hudsonius*, the rufous of which, how-

ever, is much browner. Specimens without the dorsal band, and with more black in the tail, also so approach var. *fremonti* as to be as well referable to this as to var. *hudsonius*. Some of the Uintah Mountain specimens also present a decided approach toward var. *richardsoni*.

GENERAL REMARKS RESPECTING *SCIURUS HUDSONIUS* AND ITS VARIETIES.

**DIFFERENTIAL CHARACTERS AND AFFINITIES.**—The four subspecies of *Sciurus hudsonius*, namely, *hudsonius*, *richardsoni*, *douglassi*, and *fremonti*, are generally readily distinguishable by their coloration, especially by the markings of the tail. In respect to size, var. *hudsonius*, as represented in the United States, is rather smaller than either of the others, but examples from Alaska and British North America equal the largest specimens of the other varieties. Vars. *richardsoni*, *douglassi*, and *fremonti* do not differ materially in size. All the varieties except *fremonti* have usually a more or less distinct reddish band along the middle of the back, which extends from the top of the head nearly to the end of the tail. This, in var. *hudsonius*, is yellowish-red; in var. *richardsoni* and *fremonti*, it is of a much darker tint, generally dark brownish-red. All are white or grayish-white below, except var. *douglassi*, which has the ventral surface fulvous or buffy. The northern representatives of the three northern varieties (*hudsonius*, *richardsoni*, and *douglassi*) are generally finely annulated on the ventral surface with black; in their southern representatives and in var. *fremonti*, these annulations are generally absent. The dorsal surface in all is finely annulated with black, the general color varying from fulvous to rufous-gray. A conspicuous black lateral line is more or less prevalent in all, especially in summer, and particularly among young specimens of var. *hudsonius*. In winter, it is frequently, if not generally, absent in all, and in var. *hudsonius* almost invariably so; late in autumn, it is generally obscure.

Var. *hudsonius* is distinguished by its lighter and more fulvous tints, being above generally pale yellowish-gray or grayish-fulvous, finely annulated with black, with generally a rather broad dorsal stripe of yellowish-red. The middle of the tail dorsally is of the same color as the middle of the back; the central reddish portion is bounded with black, the latter being fringed with pale yellow.

Var. *richardsoni* differs mainly from var. *hudsonius* in the general color of the upper surface being darker or more rufous, with the dorsal stripe

brownish-red, and in the central portion of the tail being also dark brownish-red, with the enclosing black bar much broader and purer black and more narrowly fringed with yellowish. Often the terminal half of the tail is almost wholly black.

Var. *douglasi* generally differs little in the general color of the dorsal surface from var. *richardsoni*, being, on the whole, rather darker or more fuscous. The tail, however, is less black, and is more broadly fringed with yellowish-white. The central portion (dorsally) is generally less strongly ferruginous, varying sometimes to gray. The ventral surface of the body, however, is tawny, thus furnishing, in typical examples, a very obvious distinctive feature.

Var. *fremonti* generally lacks the central dorsal stripe, and the fulvous of the upper surface inclines more strongly to yellow. The tail is generally gray centrally above (sometimes more or less fulvous or rufous), with a broad enclosing zone of black, broadly fringed with pure white.

These varieties, in their extreme phases, appear very distinct, yet wherever their respective habitats meet their characters become very much blended. Thus, as already noted, in Northwestern Wyoming, where meet the habitats of varieties *hudsonius*, *richardsoni*, and *fremonti*, a considerable proportion of the specimens received from this region can scarcely be referred to one of the varieties rather than to another. Many of the specimens present distinctly traces of the leading characteristics of the three forms; others, while presenting considerable resemblance to *hudsonius*, incline most strongly to var. *richardsoni*; others, again, toward *fremonti*. Others still, both from this region and from localities much farther westward, combine the leading features of vars. *richardsoni* and *fremonti*. Specimens from the region where the habitats of *richardsoni* and *douglasi* meet are again variously intermediate between these two forms, being generally distinguishable only by the color of the ventral surface. In California, where the habitats of *douglasi* and *fremonti* meet, the same localities furnish typical examples of each form, with others variously intermediate between them. Professor Baird, in 1857, with far less material before him than has passed under the examination of the present writer, in referring to the gray-tailed specimens from California, says:—"In this condition the tail exactly resembles, in every respect, that of *S. fremonti*, and the two [*S. douglasi* and *S. fremonti*], comparing Nos. 1160 [*S. douglasi* from the Upper Des Chutes] and 520 [*S. fremonti* from Sawatch Pass,

Rocky Mountains], could not be distinguished from each other, except by the white belly of the latter. I consider it quite possible, if not very probable, that these may be two varieties of color of the same species."\*

GEOGRAPHICAL DISTRIBUTION.—The habitat of *Sciurus hudsonius* (including under this term its several varieties) embraces the greater part of the North American continent, extending northward to the limit of forest vegetation and southward over the northern two-thirds of the United States. The eastern variety (subspecies *hudsonius*) has a far more extensive range than all of the others together; its habitat embracing nearly all of North America (north of about lat. 34°) east of the Rocky Mountains, and extending northward westward over most of Alaska. Its southern limit in the United States is quite irregular, terminating on the Atlantic coast near the Delaware Bay, but occupying the highlands of the interior as far southward as Northern Georgia and Northern Alabama, while one specimen in the collection of the National Museum is labelled as coming from as far south as Monticello, Miss. In the vicinity of Washington, D. C., it is occasionally found; I have lately seen a specimen from this locality, regarded as a rarity by the local collectors. In the Mississippi Valley, it is not common south of Central Illinois and Northern Missouri. Woodhouse, however, notes its occurrence in the Indian Territory. Northward, it is reported from Labrador and the region about Hudson's Bay, and specimens are in the collection from as far north as Fort Anderson, the Yukon River, and Nulato. It extends westward to the eastern base of the Rocky Mountains.

Subspecies *richardsoni* inhabits the Rocky Mountain region of Western Montana and Northern Idaho, ranging thence westward to the Cascade Range and northward considerably into British America, but to what distance is thus far not definitely known. Subspecies *douglasi* occupies the Pacific coast from Central California northward to British Columbia, but is confined mainly to the narrow belt west of the Coast Ranges. Its northern limit is not yet known, but it ranges northward to Sitka, and probably to Southern Alaska. Subspecies *fremonti* occupies the more southern portion of the Rocky Mountains, from Southern Wyoming to New Mexico, and thence westward over Utah, Southern Idaho, and Nevada to California. It is quite abundant in the mountains of Colorado, and there are also specimens in the collection from the Uintah Mountains.

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\* Mamm. N. Amer. p. 277.

**GEOGRAPHICAL VARIATION.**—Subspecies *hudsonius*, as already noted, varies considerably in size and color with locality. As a rule, northern specimens are considerably larger than southern ones; but, on the other hand, New England specimens are much smaller than those from Central Pennsylvania or than those from localities farther west having the same latitude as New England. Specimens from Minnesota and thence westward are among the largest examined. Northern specimens, as also those from the Black Hills, are paler or more fulvous than specimens from the eastern portions of the United States; they are, at the same time, more distinctly annulated below with black. Specimens from the Eastern and Middle States are hence more intensely white below and more rufous above than those from more northern localities. Var. *richardsoni* appears to attain its greatest degree of specialization in the Bitter Root Range, near the eastern boundary of Idaho Territory, ranging more toward the *hudsonius* phase farther eastward, and toward *fremonti* and *douglassi* respectively southward and westward. Var. *douglassi* varies quite markedly with the latitude, southern specimens being smaller than northern ones, and somewhat differently colored, especially in being less annulated with black below. Var. *fremonti* appears to be more constant in its coloration than either of the others, and the differences presented by different specimens appear to be more individual than geographical.

**SYNONYMY AND NOMENCLATURE.**—Neither of the varieties of *Sciurus hudsonius* has any very prominent synonyms. The eastern form was at first referred by Forster to the *Sciurus vulgaris* of Europe. Erxleben, in 1777, likewise referred it to *S. vulgaris*, but distinguished it as var. *hudsonicus*. The following year it was described by Pallas under the name *Sciurus hudsonius*, by which name it has ever since been currently known. Ord (according to Baird), in 1815, applied to it the name *carolinus*. The name *rubrolineatus* of Desmarest is the name of a nominal species, recognized by only a few writers, referable to *hudsonius*. Following the strict rule of priority, the name should probably be written *hudsonicus* (from Erxleben), this being the first distinctive appellation given to this form, it having apparently a priority of one year over *hudsonius*.

The next form designated by a systematic name is var. *douglassi*, first named by Gray in 1836, and first described by Bachman in 1838. It is the "Small Brown Squirrel" of Lewis and Clarke, and the "*Sciurus hudsonius* var.  $\beta$ " of Richardson, based on Lewis and Clarke's description. Gray

renamed the same form *belcheri* in 1842, and Baird, in 1855, distinguished *Sciurus suckleyi*, which two years later, after the reception of additional specimens, he himself referred to *douglassi*. The *S. lanuginosus* of Bachman is based on a white-bellied, light-colored specimen, said by Townsend to have been collected at Sitka. It agrees very well with the light-colored, white-bellied phase of *douglassi* from Fort Crook, Cal, and I have little doubt is referable to *douglassi*. Professor Baird, however, regarded it, after an examination of the specimen, as an albinistic example of *S. richardsoni*, admitting, however, that it is possibly referable to *douglassi*, which view the locality, if correctly stated, certainly favors. To this variety is also referable the *S. mollipilosus* of Audubon and Bachman, based on a specimen from the "northern parts of California", in which the lower parts were cinereous, slightly tinged in places with rufous.

The form next specifically distinguished was the *S. richardsoni* of Bachman, based on a small specimen from the "high range of the Rocky Mountains, west of the great chain" (probably the Bitter Root Range). It is not the same, however, as the *S. hudsonius* var.  $\beta$  of Richardson, as supposed by Bachman. This is the origin of the name *richardsoni*, which appears to have no synonyms.

Var. *fremonti* was first described by Audubon and Bachman, in 1853, from a specimen collected by Fremont in the vicinity of the South Pass. A second specimen, from Sawatch Pass, was described by Baird in 1857, at which time these two were the only specimens known. This form is also fortunately without synonyms. Gray, in 1867, regarded it as a variety of *S. douglassi*.

Since 1857, when Professor Baird treated each of these forms as distinct species, the material available for their study has vastly increased. The specimens of var. *fremonti* have increased from the two then known to upward of fifty. The five specimens of var. *richardsoni* have increased to upward of forty. Many additional examples of var. *douglassi* have also come to hand, together with a large series from Northwestern Wyoming, collected under the auspices of the present Survey, illustrating the unquestionable intergradation of the Rocky Mountain forms with the eastern or *hudsonius* type. While this additional material places beyond reasonable doubt the complete intergradation of these diverse geographical forms, the exact boundaries of their respective habitats remain yet to be determined, as well



as the peculiar phases of intergradation occurring over considerable areas where adjoining varieties presumably interblend. Not less important is the large series of the *hudsonius* type from Arctic America, which, under a slightly modified phase, is found to range throughout the great northern interior of the continent and northwestward over the larger portion of Alaska to Norton Sound.

TABLE VI.—Measurements of thirty-four specimens of *SCIURUS HUDSONIUS* var. *HUDSONIUS*.\*

Catalogue number.	Original number.	Locality.	From tip of nose to—					Tail to end of—		Length of—		Height of ear	Nature of specimen.	Remarks.
			Sex.	Eye.	Ear.	Occiput.	Tail.	Vertebra.	Hair.	Fore foot.	Hind foot.			
4442	.....	Nulato, Alaska.	♂	0.77	1.55	1.96	7.75	4.70	6.90	1.17	1.93	0.59	Fresh	Collector's measurements.
4481	33	Fort Simpson, H. B. T.	♂	1.05	1.71	2.65	7.90	5.30	7.30	1.35	1.80	0.68	do	
4480	34	do	♂	1.05	1.90	2.65	7.80	4.90	7.00	1.50	1.85	0.70	do	
4491	309	G's Slave Lake, H. B. T.	♂	.....	.....	2.00	7.65	4.70	6.70	.....	.....	.....	do	do
824	.....	Lake Winnipeg	♀	0.85	1.43	2.00	7.00	4.75	5.40	1.15	1.80	0.55	Alcoholic	
1076	.....	Minneapolis, Min.	♀	0.89	1.53	1.90	8.50	5.10	7.00	1.17	1.80	0.57	do	
3907	.....	Grand Menan	♀	0.75	1.40	1.93	6.75	3.95	5.75	1.03	1.65	0.58	do	
3906	.....	do	♀	0.77	1.50	1.90	6.00	3.10	5.30	1.15	1.70	0.54	do	
3792	.....	Lake Richardson, Ma.	♀	0.78	1.55	1.85	6.00	4.50	5.40	1.15	1.80	0.57	do	
823	.....	do	♂	0.77	1.55	1.85	6.65	4.00	6.00	1.15	1.75	0.50	do	
905	.....	do	♀	0.73	1.45	1.80	6.80	4.40	5.25	1.13	1.65	0.50	do	
3336	.....	Gardiner, Mo.	♀	0.79	1.50	1.90	6.65	4.50	6.00	1.15	1.75	0.48	do	
594	.....	Norway, Mo.	♀	0.90	1.45	1.80	6.50	3.85	5.45	1.06	1.80	0.50	do	
998	.....	do	♀	0.65	1.50	1.85	7.00	4.45	5.95	1.17	1.65	0.63	do	
3711	.....	Amherst, N. H.	♀	0.80	1.42	1.88	6.78	4.50	6.70	1.90	1.75	0.65	do	
3710	.....	do	♀	0.73	1.45	1.85	6.45	5.00	6.70	1.90	1.80	0.63	do	
3129	.....	do	♀	0.68	1.50	1.98	6.10	4.75	6.60	1.14	1.87	0.65	do	
3735	.....	do	♀	0.65	1.57	1.70	6.00	3.50	5.48	1.15	1.78	0.60	do	
3719	.....	do	♀	0.65	1.46	1.98	7.00	5.00	6.15	1.14	1.74	0.60	do	
3725	.....	do	♀	0.77	1.48	1.78	6.45	4.45	5.37	1.10	1.70	0.55	do	
905	.....	do	♀	0.78	1.48	1.70	6.55	4.57	6.30	1.15	1.68	0.63	do	
3799	.....	do	♂	0.75	1.50	1.90	6.95	4.35	6.10	1.15	1.63	0.60	do	
1308	.....	do	♂	0.77	1.48	1.88	6.60	4.70	.....	1.15	1.68	0.50	do	
149	.....	Concord, Mass.	♀	0.68	1.44	1.90	6.80	4.50	6.25	1.19	1.68	0.60	do	
3735	.....	Woburn, Mass.	♂	0.88	1.47	1.90	6.75	4.10	6.45	1.14	1.60	0.60	do	
3734	.....	do	♂	0.63	1.50	1.70	6.75	3.20	5.40	1.10	1.68	0.63	do	
3573	.....	Cambridge, Mass.	♂	0.68	1.60	2.01	7.85	4.45	6.50	1.95	1.67	0.60	do	
907	.....	Lynn, Mass.	♂	0.75	1.43	1.90	6.80	4.70	6.00	1.93	1.75	0.60	do	
143	.....	Malden, Mass.	♀	0.77	1.40	1.83	6.55	4.30	5.00	1.18	1.77	0.55	do	
100	.....	Springfield, Mass.	♂	0.60	1.53	1.70	7.50	5.00	6.65	1.18	1.69	0.67	do	
2697	.....	Carlisle, Pa.	.....	0.60	1.50	2.00	7.85	5.00	6.50	1.90	1.60	.....	do	From Baird's Mamm. N. Am. p. 570
2408	.....	do	.....	0.60	1.50	1.95	7.40	5.00	6.45	1.10	1.75	.....	do	do
2148	.....	Monticello, Minn.	.....	0.60	1.50	1.85	6.95	3.50	4.95	0.90	1.50	.....	do	do
645	.....	Elizabeth, N. Y.	♀	.....	.....	2.00	7.55	5.00	6.75	.....	.....	.....	Fresh	Collector's measurements.

\* All fully adult specimens; the females in nearly every case give evidence of having suckled young. The first four are from the National Museum; the others are from the Museum of Comparative Zoology, Cambridge, Mass.



TABLE VII.—Measurements of thirty-six skulls of *SCIURUS HUDSONIUS* var. *HUDSONIUS*.

Catalogue number.	Locality.	Sex.	Total length.	Greatest width.	Distance between orbits.	Nasal bones, length.	Nasal bones, width behind.	Upper incisors from front to snout.	Upper incisors from front to snout margin of palates.	Upper incisors, height.	Up- or incisors, width between external edges.	Upper molars, length taken together.	Upper molars, distance between.	Lower jaw, length.	Lower jaw, height.
4970	Fort Simpson, H. B. T.	♂	1.90	1.08	0.65	0.57	0.16	0.09	0.93	0.25	0.16	0.33	0.59	1.10	0.60
4977	do	♂	1.89	1.07	0.64	0.53	0.15	0.06	0.90	0.24	0.17	0.31	0.59	1.07	0.60
4980	do	♂	1.84	1.06	0.63	0.55	0.15	0.05	0.95	0.25	0.18	0.33	0.59	1.07	0.60
4981	do	♂	1.86	1.10	0.63	0.56	0.14	0.09	0.94	0.25	0.16	0.32	0.58	1.06	0.60
4983	do	♂	1.53	1.03	0.60	0.57	0.13	0.07	0.91	0.24	0.15	0.29	0.51	1.05	0.60
4984	do	♀	1.84	1.10	0.63	0.53	0.15	0.05	0.90	0.25	0.18	0.33	0.59	1.07	0.60
4986	do	♂	1.83	1.08	0.63	0.57	0.17	0.05	0.93	0.25	0.18	0.33	0.59	1.07	0.60
4987	do	♂	1.81	1.06	0.63	0.53	0.15	0.04	0.94	0.25	0.18	0.33	0.59	1.07	0.60
4998	do	♂	1.81	1.06	0.63	0.53	0.15	0.05	0.95	0.25	0.18	0.33	0.59	1.07	0.60
4999	do	♂	1.86	1.08	0.63	0.57	0.15	0.06	0.93	0.25	0.18	0.33	0.59	1.07	0.60
5168	Greensburg, Pa.	♂	1.76	1.01	0.70	0.10	0.39	0.45	0.97	0.17	0.06	0.50	1.00	0.57	0.57
5169	do	♂	1.83	1.03	0.68	0.19	0.50	0.09	0.90	0.18	0.20	0.50	1.03	0.56	0.56
5171	do	♂	1.80	1.06	0.66	0.14	0.55	0.01	0.98	0.18	0.53	0.52	1.03	0.56	0.56
5172	do	♂	1.75	1.03	0.67	0.15	0.55	0.09	0.97	0.18	0.53	0.52	1.03	0.56	0.56
5173	do	♂	1.80	1.04	0.66	0.16	0.55	0.09	0.97	0.18	0.53	0.52	1.03	0.56	0.56
5175	do	♀	1.70	1.00	0.66	0.16	0.55	0.09	0.97	0.18	0.53	0.52	1.03	0.56	0.56
5176	do	♂	1.75	1.00	0.66	0.14	0.53	0.05	0.97	0.18	0.53	0.52	1.03	0.56	0.56
5178	Greensburg, Pa.	♂	1.83	1.08	0.63	0.16	0.60	0.09	0.99	0.25	0.18	0.33	0.59	1.07	0.60
5179	do	♀	1.84	1.09	0.63	0.16	0.56	0.01	0.99	0.25	0.18	0.33	0.59	1.07	0.60
5180	do	♀	1.80	1.03	0.65	0.16	0.56	0.01	0.99	0.25	0.18	0.33	0.59	1.07	0.60
906	Upton, Oxford Co., Me.	♂	1.75	0.97	0.65	0.23	0.19	0.39	0.95	0.25	0.18	0.33	0.59	1.07	0.60
908	do	♂	1.70	0.96	0.66	0.20	0.15	0.51	0.93	0.25	0.18	0.33	0.59	1.07	0.60
918	do	♂	1.70	1.00	0.58	0.20	0.17	0.50	0.93	0.25	0.18	0.33	0.59	1.07	0.60
915	do	♂	1.70	1.05	0.58	0.20	0.15	0.51	0.97	0.25	0.18	0.33	0.59	1.07	0.60
917	do	♂	1.76	0.98	0.60	0.53	0.14	0.53	0.97	0.25	0.18	0.33	0.59	1.07	0.60
919	do	♂	1.69	0.98	0.57	0.48	0.13	0.59	0.97	0.25	0.18	0.33	0.59	1.07	0.60
994	do	♂	1.67	0.97	0.56	0.47	0.15	0.49	0.98	0.25	0.18	0.33	0.59	1.07	0.60
919	do	♀	1.73	0.96	0.58	0.50	0.14	0.53	0.97	0.25	0.18	0.33	0.59	1.07	0.60
925	do	♀	1.77	1.08	0.58	0.50	0.10	0.53	0.99	0.25	0.18	0.33	0.59	1.07	0.60
922	do	♀	1.75	1.03	0.60	0.58	0.13	0.79	0.97	0.25	0.18	0.33	0.59	1.07	0.60
981	do	♀	1.75	1.08	0.60	0.58	0.13	0.55	0.99	0.25	0.18	0.33	0.59	1.07	0.60
990	do	♀	1.73	1.00	0.57	0.47	0.15	0.59	0.95	0.25	0.18	0.33	0.59	1.07	0.60
935	Amherst, N. H.	♂	1.66	1.04	0.61	0.57	0.14	0.53	0.99	0.25	0.18	0.33	0.59	1.07	0.60
933	Malden, Mass.	♂	1.77	1.05	0.60	0.49	0.14	0.54	0.99	0.25	0.18	0.33	0.59	1.07	0.60
933	Cambridge, Mass.	♂	1.77	1.04	0.60	0.59	0.15	0.59	0.99	0.25	0.18	0.33	0.59	1.07	0.60
1986	Massachusetts?	♂	1.80	1.08	0.64	0.50	0.16	0.55	0.99	0.25	0.18	0.33	0.59	1.07	0.60

TABLE VIII.—Measurements of thirteen specimens of SCIURUS HUDSONIUS var. RICHARDSONI.

Catalogue-number.	Original number.	Locality.	Sex.	From tip of nose to—				Tail to end of—		Length of—		Height of ear.	Measure of specimen.	Remarks.
				Eye.	Ear.	Occiput.	Tail.	Vertebra.	Hair.	Fore foot.	Hind foot.			
11984	4583	Chief Mt. Lake, 49° N. parallel.	♂	0.70	1.00	2.00	7.25	5.90	7.00	1.00	2.00	.....	Fresh.	Collector's measurements.
11983	4003	.....do.....	♂	0.80	1.40	2.10	7.50	5.90	7.75	1.90	1.95	.....do.....	.....do.....	.....do.....
914	.....	St. Mary's, R. Mts.	.....	.....	.....	.....	0.00	5.00	8.00	.....	1.83	0.50	Skin ..	.....do.....
915	.....	.....do.....	.....	.....	0.69	1.44	.....	8.50	5.10	7.15	1.70	0.55	.....do.....	.....do.....
913	.....	Rocky Mts., 49th par.	.....	.....	.....	.....	7.00	5.45	.....	.....	1.87	.....	.....do.....	.....do.....
5974	.....	Camp Xootenay.....	♂	0.90	1.75	2.00	8.50	.....	.....	.....	.....	.....	.....do.....	.....do.....
4134	.....	Bitter Root Valley..	.....	0.85	1.60	.....	7.60	4.65	6.20	.....	1.83	0.57	.....do.....	.....do.....
4142	991	.....do.....	♂	0.88	1.70	.....	8.10	4.50	6.40	1.15	1.25	.....	.....do.....	.....do.....
4145	558	.....do.....	♂	0.75	1.45	.....	7.25	4.50	6.00	.....	1.83	0.50	.....do.....	.....do.....
4190	786	Hell Gate, R. Mts..	♂	0.83	1.52	.....	7.30	3.20	5.00	1.10	.....	.....	.....do.....	.....do.....
4185	768	.....do.....	♂	0.55	1.00	.....	7.25	4.00	5.80	1.10	1.85	0.50	.....do.....	.....do.....
4175	790	.....do.....	.....	0.94	1.45	.....	7.75	.....	.....	.....	1.80	.....	.....do.....	.....do.....
4186	789	.....do.....	.....	0.90	1.55	2.10	7.60	.....	.....	.....	1.82	.....	.....do.....	.....do.....

TABLE IX.—Measurements of three skulls of SCIURUS HUDSONIUS var. RICHARDSONI.

Catalogue-number.	Locality.										
		Total length.	Greatest width.	Nasal bones, length.	Nasal bones, width behind.	Upper incisors from front to base.	Upper incisors from front to under margin of palato.	Upper molar, length taken together.	Upper molar, distance between.	Lower jaw, length.	Lower jaw, height.
1184	Saint Mary's River, Oregon.....	1.87	.....	0.57	0.15	0.57	0.98	0.33	0.21	1.10	0.60
3008	Camp Skagit, W. T.....	1.96	1.10	0.58	0.15	0.57	0.95	0.33	0.23	1.12	0.61
3305	Black Hills, Dak.....	1.98	1.15	0.58	0.15	0.60	0.95	0.30	0.26	.....	.....

TABLE X.—Measurements of fifteen specimens of *SCIURUS HUDSONIUS* var. *DOUGLASSI*.

Catalogue number.	Original number.	Locality.	Sex.	From tip of nose to—				Tail to end of—		Length of—		Height of ear.	Nature of specimen.	Remarks.
				Eye.	Ear.	Occiput.	Tail.	Vertebra.	Hairs.	Fore foot.	Hind foot.			
9494	.....	Fort Steilacoom, W. T.	♂	0.80	1.65	1.98	7.50	4.90	6.50	1.90	1.95	0.64	Alcoholic.	
979	.....	do					8.00	4.50	6.00	.....	1.80	0.50	Skin	Measurements from Baird's Mamm. N. Amer., p. 978.
973	.....	do					8.50	4.85	6.00	.....	1.90	.....	do	do.
9493	.....	do	♂	0.90	1.70	1.90	8.00	.....	.....	1.30	2.00	.....	Alcoholic.	do.
9495	.....	do	♂	0.90	1.70	2.00	7.50	5.00	6.00	1.30	2.00	.....	do	do.
9496	.....	do	♀	0.80	1.50	1.80	6.50	4.50	5.25	1.10	1.80	.....	do	do.
918	.....	Chickwas, W. T.	♂				7.50	4.50	6.25	.....	1.85	0.50	Skin	do.
1865	.....	Upper Des Chutes, Columbia R.					7.50	3.75	5.25	.....	1.90	.....	do	do.
1160	.....	do					8.00	4.00	5.00	.....	2.00	.....	do	do.
1194	.....	do					8.00	4.00	5.00	.....	1.90	.....	do	do.
9499	300	Petaluma, Cal.		0.80	1.70	1.90	7.00	5.25	6.00	1.25	1.90	.....	Fresh	do.
9493	.....	do	♀	0.90	1.60	1.60	7.00	5.25	7.00	1.90	2.00	.....	Alcoholic.	do.
9410	.....	do	♂	0.90	1.70	1.90	7.00	5.00	7.00	1.30	1.85	.....	do	do.
9411	.....	do	♂	0.90	1.50	1.75	7.00	4.75	5.25	1.55	1.70	.....	do	do.
9412	.....	do	♂	0.85	1.70	1.90	7.25	5.50	7.00	1.80	2.00	.....	do	do.

TABLE XI.—Measurements of five skulls of *SCIURUS HUDSONIUS* var. *DOUGLASSI*.

Catalogue number.	Locality.													
		Total length.	Greatest width.	Distance between orbits.	Nasal bones, length.	Nasal bones, width behind.	Upper incisors from front to molars.	Upper incisors from front to hinder margin of palatine.	Upper molars, length taken together.	Upper molars, distance between.	Lower jaw, length.	Lower jaw, height.		
9001	Washington Territory	1.83	1.06	0.66	0.29	0.17	0.60	0.94	0.33	0.94	1.05	0.56		
1863	Oregon	1.80	1.03	0.60	0.17	0.53	0.80	0.94	0.33	0.94	1.05	0.53		
2880	Upper Des Chutes	1.90	1.06	0.63	0.16	0.57	0.94	0.94	0.33	0.94	1.05	0.53		
9414	Petaluma, Cal.	1.81	1.03	0.58	0.17	0.70	0.98	0.98	0.33	0.98	1.00	0.58		
6085	Washington Territory	1.78	1.00	0.55	0.17	0.55	0.90	0.90	0.33	0.90	1.00	0.55		

TABLE XII.—Measurements of eight specimens of *SCIURUS HUDSONIUS* var. *FREMONTI*.

Catalogue-number.	Original number.	Locality.	Sex.	From tip of nose to—				Tail to end of—		Length of—		Height of ear.	Nature of specimen.
				Eye.	Ear.	Occiput.	Tail.	Vertebra.	Hair.	Fore foot.	Hind foot.		
9884	718	Near South Park, Colo.	♂	0.93	1.03	2.07	7.95	4.00	6.30	1.90	1.05	.....	Fresh.
9885	721	.....do.....	.....	1.05	1.77	2.10	7.75	4.85	6.50	1.90	1.00	.....	do.
9886	857	.....do.....	♀	0.93	1.05	1.95	7.50	4.70	6.50	1.90	1.00	.....	do.
11504	.....	Colorado	.....	0.87	1.55	1.90	8.00	.....	.....	.....	1.75	.....	Skin.
11679	846	Fort Garland, Colo.	♂	0.87	1.73	.....	.....	.....	.....	1.15	1.78	.....	do.
.....	.....	.....do.....	.....	0.97	1.70	2.00	7.75	5.25	6.90	1.15	2.00	0.65	Alcoholic.
.....	.....	.....do.....	.....	0.85	1.57	1.97	7.75	5.10	6.80	1.15	2.00	0.73	do.
.....	.....	.....do.....	.....	0.90	1.70	2.05	8.25	5.20	.....	1.20	2.00	0.73	do.

\* In Museum of Comparative Zoology, Cambridge, Mass.

TABLE XIII.—List of specimens examined of *SCIURUS HUDSONIUS* var. *HUDSONIUS*.

Catalogue-number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.	Remarks.
.....	.....	1449	♂	Nulato, R. Am.	.....	W. H. Dall	W. H. Dall	Alcoholic	Nearly indistinguishable from average eastern skins. Thorax a little paler and the dark annulations a little broader and rather more black in the tail. Ears conspicuously tufted. In color almost indistinguishable from Red River skins.
9939	.....	505	♀	do	Jan. 31, 1897	do	do	Skin	
9934	.....	809	♂	do	Apr. 25, 1897	do	do	do	
9930	.....	590	.....	do	do	do	do	do	
9933	.....	710	♂	Woolyestuka, R. Am.	Apr. 3, 1897	do	do	do	
9941	.....	833	♀	Koroukuk, R. Am.	.....	do	do	do	
9777	.....	.....	.....	Lower Krichpak.	.....	.....	O. de Benedicben.	do	
8105	.....	.....	.....	Fort Anderson, Arctic Coast.	Aug., 1898	.....	.....	do	
8106	.....	.....	♀	Yukon, mouth of Porcupine.	.....	.....	J. Lockhardt	do	
4405	4388	46	♂	Fort Simpson, Mackenzie R.	May 9, 1899	R. R. Ross	R. R. Ross	Skin and skull	
4461	.....	36	♀	do	Apr. 13, 1899	do	do	Skin	
4463	4779	87	♂	do	Mar. 19, 1899	do	do	Skin and skull	
4464	.....	99	♂	do	Mar. 17, 1899	do	do	Skin	
4475	.....	96	♂	do	Mar. 19, 1899	do	do	do	
4476	.....	35	♂	do	Apr. 6, 1899	do	do	do	
4481	.....	33	♂	do	Mar. 31, 1899	do	do	do	
7027	.....	1159	.....	do	.....	R. Kennicott	R. Kennicott	do	
4491	.....	253	♂	do	.....	do	do	do	
4499	4336	.....	.....	do	.....	do	do	Skin and skull	

TABLE XIII.—List of specimens examined of *SCIURUS HUDSONIUS* var. *HUDSONIUS*—Continued.

Catalogue-number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.	Remarks.
4407	4339	959	♀	Fort Simpson, Mackenzie R.	.....	R. Kennicott	R. Kennicott	Skin and skull	
4471	4976	.....	♂	do	.....	B. R. Ross	B. R. Ross	do	
4468	4277	.....	♂	do	.....	do	do	do	
4467	4979	.....	♀	do	.....	do	do	do	
4456	4380	.....	♀	do	.....	do	do	do	
4459	4281	.....	♂	do	.....	do	do	do	
4475	4293	.....	♂	do	.....	do	do	do	
4457	4283	.....	♀	do	.....	do	do	do	
4460	4284	.....	♀	do	.....	do	do	do	
4471	4285	.....	♂	do	.....	do	do	do	
4469	4286	.....	♂	do	.....	do	do	do	
4405	4287	.....	♂	do	.....	do	do	do	
4456	4289	.....	♂	do	.....	do	do	do	
4469	4290	.....	♂	do	.....	do	do	do	
4495	4337	.....	.....	Fort Rae, Great Slave Lake.	.....	do	L. Clarke, Jr.	Skull	
.....	6846	.....	.....	do	.....	do	do	do	
.....	6847	.....	.....	do	.....	do	do	do	
.....	6849	.....	.....	do	.....	do	do	do	
4494	389	.....	♂	do	Apr. 15, —	do	do	Skin	
5639	957	.....	.....	do	.....	do	do	do	
4484	.....	.....	.....	do	.....	do	do	do	
8743	147	.....	.....	Fort Good Hope, H. B. T.	Oct. 1, 1864	.....	C. P. Gaudet	do	
8744	333	.....	.....	do	.....	.....	do	do	
8745	344	.....	.....	do	.....	.....	do	do	
8746	335	.....	.....	do	June 10, 1865	.....	do	do	
8747	138	.....	.....	do	Oct. —, 1864	.....	do	do	
9018	.....	.....	.....	Ft. Liard, H. B. T.	Mar. —, 1867	.....	W. McFarlane	Albino.	
11533	3925	.....	.....	Ft. Pembina, D. T.	July 5, 1873	A. Campbell	Dr. E. Coues	Skin	Very pale.
11534	9894	.....	♂	do	June 6, 1873	do	do	do	do
11536	2000	.....	♀	do	June 7, 1873	do	do	do	do
11537	2063	.....	♀	do	June 13, 1873	do	do	do	do
11538	3366	.....	♀	Turtle Mt., D. T.	July 28, 1873	do	do	do	do
11539	.....	.....	.....	do	July 31, 1873	do	do	do	do
4269	.....	.....	.....	Roadbud Creek	Oct. —, 1859	Capt. W. F. Hayden.	Dr. F. V. Hayden.	do	Very pale, with dorsal band tawny red.
4970	33	.....	.....	Big Indian Creek	—, 1859	do	do	do	
3951	.....	.....	.....	Black Hills, head of Cheyenne R.	Sept. 30, 1859	do	do	do	Very pale; very little black in tail.
3250	.....	.....	.....	Black Hills, Nebr.	.....	do	do	do	Very tawny.
3249	.....	.....	.....	Bear Buttes, Bk Hills.	Sept. 30, 1859	do	do	do	do
3345	.....	.....	.....	do	.....	do	do	do	do
3246	.....	.....	.....	Laramie Peak	.....	J. H. Homan	J. H. Homan	do	
4353	476	.....	♀	Fort George	.....	W. M. F. McGraw.	C. Drexler	do	
3217	.....	.....	.....	Red River, H. B. T.	.....	D. Gunn	D. Gunn	do	
3209	.....	.....	.....	do	.....	do	do	do	
3719	.....	.....	.....	do	.....	do	do	do	

TABLE XIII.—List of specimens examined of SCIURUS HUDSONIUS var. HUDSONIUS—Continued.

Catalogue number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.	Remarks.
3911				Red River, H. B. T.		D. Gunn.	D. Gunn.	Skin	
3904				Princeton, Minn.		O. E. Garrison	O. E. Garrison	do	
185				Grosse Isle, Mich.		C. Fox	C. Fox	do	
187				do		do	do	do	
99				do	May —, 1838	do	do	do	
184				Cleveland, Ohio		Dr. Kirtland	Dr. Kirtland	do	
183				do		do	do	do	
3269				Labrador		Dr. J. B. Gilpin	Dr. J. B. Gilpin	do	
3267				do		do	do	do	
3266				do		do	do	do	
3052				Halifax, N. S.		do	do	do	
3050				do		do	do	do	
3037				do		do	do	do	
3265				Nova Scotia		do	do	do	
16				Montreal, Canada		do	do	do	
*194		♀		Lake Winnipeg		S. H. Scudder	S. H. Scudder	Alcohol	
*173		♀		Minneapolis, Minn.		H. Mann, jr.	H. Mann, jr.	do	
*96		♂		Lawn Ridge, Ill.		H. Butler	H. Butler	do	
*932				St. Lawrence Co., N. Y.		J. S. Foley	J. S. Foley	do	
*457				Pvt. Jarvis, N. Y.		N. S. Shaler	N. S. Shaler	do	
*200		♂		Grand Menan Isl.		A. E. Verrill	A. E. Verrill	do	
*207		♀		do		do	do	do	
*53		♂		Umbragog Lake, Ma.		Gray Fund.	J. G. Eich	do	
*905		♀		Lake Richardson, Ma.		A. E. Verrill	A. E. Verrill	do	
*379		♀		do		do	do	do	
*908				Upton, Me.		Gray Fund.	J. G. Eich	Skull	
*509				do		do	do	do	
*910				do		do	do	do	
*911				do		do	do	do	
*915				do		do	do	do	
*916				do		do	do	do	
*917				do		do	do	do	
*918				do		do	do	do	
*919				do		do	do	do	
*920				do		do	do	do	
*921				do		do	do	do	
*922				do		do	do	do	
*923				do		do	do	do	
*924				do		do	do	do	
*925				do		do	do	do	
*926				do		do	do	do	
*927				do		do	do	do	
*928				do		do	do	do	
*929				do		do	do	do	
*930				do		do	do	do	
*931				do		do	do	do	
*538		♀		Gardiner, Me.		L. Agassiz	L. Agassiz	Alcohol	
*594		♀		Norway, Me.		Gray Fund.	R. D. Verrill	do	
*595				do		do	do	do	
*596				do		do	do	do	
*597				do		do	do	do	

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TABLE XIII.—List of specimens examined of *SCIURUS HUDSONIUS* var. *HUDSONIUS*—Continued.

Catalogue number of skin.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.	Remarks.
*937			Norway, Me.		Gray Fund.	A. E. Verrill	Skull	
*938			do		do	do	do	
*905		♂	Amherst, N. H.		Miss A. M. Edmands.	Miss A. M. Edmands	Alcoholic	
*1003		♂	do		do	do	do	
*3719		♂	do		do	do	do	
*3720		♂	do		do	do	do	
*3721		♀	do		do	do	do	
*3722			do		do	do	do	
*3723		♀	do		do	do	do	
*3724			do		do	do	do	
*3725		♀	do		do	do	do	
*3726		♀	do		do	do	do	
*3743			do		W. H. Melendy	W. H. Melendy	do	
*3744			do		do	do	do	
*953			do		do	do	Skull	
*954			do		do	do	do	
*955			do		do	do	do	
*1009			Milford, N. H.		S. Tenney	S. Tenney	Skin	
*1100			do		do	do	do	
*1008			do		do	do	do	
*970			do		do	do	do	
*978			do		do	do	do	
*3103			do		do	do	do	
*3104			do		do	do	do	
*3105			do		do	do	do	
*3106			do		do	do	do	
*3733			do		do	do	do	
*3799			Deerfield, Mass.		L. Agassiz	L. Agassiz	do	
*3793			do		do	do	do	
*3794			do		do	do	do	
*3884			Hudson, Mass.		S. Jillean	S. Jillean	do	
*9806	350 ♀		Newtonville, Mass.		C. J. Maynard	C. J. Maynard	do	
*1710	14 ♂		do		do	do	do	
*1711	44 ♀		do		do	do	do	
*1719	78 ♂		do		do	do	do	
*1713	78 ♀		do		do	do	do	
*9491	153 ♀		do		do	do	do	
*9499	114 ♀		do		do	do	do	
*9493	159 ♀		do		do	do	do	
*9494	113 ♀		do		do	do	do	
*9496	95 ♀		do		do	do	do	
*9497	94 ♀		do		do	do	do	
*9498	93 ♂		do		do	do	do	
*9495	175 ♂		do		do	do	do	
*1464			Massachusetts		L. Agassiz	L. Agassiz	do	
*1465			do		do	do	do	
*1466			do		do	do	do	
*1467			do		do	do	do	
*1468			do		do	do	do	
*1469			do		do	do	do	

\* In the Museum of Comparative Zoölogy, Cambridge, Mass.

TABLE XIII.—List of specimens examined of *SCIURUS HUDSONIUS* var. *HUDSONIUS*—Continued.

Catalogue-number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.	Remarks.
*1470				Massachusetts		L. Agassiz	L. Agassiz	Skin	
*1471				do		do	do	do	
*1472				do		do	do	do	
*1473				do		do	do	do	
*1474				do		do	do	do	
*1475				do		do	do	do	
*1476				do		do	do	do	
*1477				do		do	do	do	
*1478				do		do	do	do	
*1479				do		do	do	do	
*1480				do		do	do	do	
*1481				do		do	do	do	
*1508				do		do	do	do	
*928				do		do	do	Skull	
*933				do		do	do	do	
*934				do		do	do	do	
*1489				Hudson, Mass		S. Jillean	S. Jillean	Skin	
*1490				do		do	do	do	
*1491				do		do	do	do	
*1492				do		do	do	do	
*149				Concord, Mass		H. Mann, Jr.	H. Mann, Jr.	Alcoholic	
*150				do		do	do	do	
*151				do		do	do	do	
*152				do		do	do	do	
*907				Lynn, Mass		S. Jillean	S. Jillean	do	
*908				do		do	do	do	
*907				do		do	do	do	
*908				do		do	do	do	
*908				do		do	do	do	
*936				do		do	do	Skull	
*3754				Woburn, Mass		J. G. Shute	J. G. Shute	Alcoholic	
*3755				do		do	do	do	
*1416				Springfield, Mass		J. A. Allen	J. A. Allen	do	
*150				do		do	do	do	
*159				do		do	do	do	
*180				do		do	do	do	
*1011				Malden, Mass		D. Higgins	D. Higgins	do	
*926				do		do	do	do	
*990				do		do	do	do	
*143				do		do	do	do	
*1098				do		do	do	do	
*3764				do		do	do	do	
*929				do		do	do	Skull	
*990				do		do	do	do	
*1007				Cambridge, Mass		M. Fowler	M. Fowler	Alcoholic	
*2670				do		L. Agassiz	L. Agassiz	do	
*415	*611			Portsmouth, N. H.		Dr. E. Cones	Dr. E. Cones	Skin and skull	
*416	*612			do		do	do	do	
*530				Saranac, N. Y.	Sept. 6, 1853	D. Walsh	D. Walsh	Skin and skull	
*549	1004			Elizabeth, N. Y.	Aug. 14, 1853	S. F. Baird	S. F. Baird	do	
*1561	*204			Essex Co., N. Y.		Dr. S. E. Hale	Dr. S. E. Hale	do	
*263	*177			do		do	do	Skull	
*264				Mt. Joy, Pa.		J. Blandford	J. Blandford	Skin	
*264				do		do	do	do	

With the lateral black lines very strong.

\* In the Museum of Comparative Zoology, Cambridge, Mass.



TABLE XIII.—List of specimens examined of *SCIURUS HUDSONIUS* var. *HUDSONIUS*—Continued.

Catalogue number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Name of specimen.	Remarks.
6316				Lebanon, Pa.		R. L. Walker.	R. L. Walker.	Skin	
8008				Pennsylvania	Mar. —, 1848	J. K. Townsend	J. K. Townsend	do	
	6163		♂	Greensburg, Pa.		F. Cowan	F. Cowan	Skull	
	6160		♂	do		do	do	do	
	6170		♀	do		do	do	do	
	6171		do	do		do	do	do	
	6173		do	do		do	do	do	
	6173		♂	do		do	do	do	
	6174		♂	do		do	do	do	
	6175		♀	do		do	do	do	
	6176		♂	do		do	do	do	
	6177		♂	do		do	do	do	
	6178		♂	do		do	do	do	
	6179		♀	do		do	do	do	
	6180		♀	do		do	do	do	
	6181		do	do		do	do	do	
	50			Carlisle, Pa.		S. F. Baird	S. F. Baird	do	
	4941			Chester Co., Pa.		E. Miehner	E. Miehner	do	
	4942			do		do	do	do	
	4943			do		do	do	do	
	737			Carlisle, Pa.		S. F. Baird	S. F. Baird	do	
1873	2485			do		do	do	Skin and skull	
	29			do		do	do	Skull	
	286			do		do	do	do	
11141			♂	Washington, D.C.		C. Drexler	C. Drexler	Skin	Red above a strong bright chestnut.
	3914			Georgia?		Dr. Jones	Dr. Jones	Skull	
9499				Monticello, Miss.		Miss Tennison	Miss Tennison	Alcohol	

TABLE XIV.—List of specimens examined of SCIURUS HUDSONIUS var. RICHARDSONI.

Catalogue number of skin.	Corresponding number of skull.	Original number.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
4134	.....	.....	Bitter Root Valley, R. Mts.	.....	Lieut. J. Mullan	John Farnall	Skin.
4135	.....	677	do	.....	do	do	do
4137	.....	608	do	.....	do	do	do
4138	.....	.....	do	.....	do	do	do
4139	.....	563	do	.....	do	do	do
4140	.....	.....	do	.....	do	do	do
4141	.....	609	do	.....	do	do	do
4143	.....	560	do	.....	do	do	do
4144	.....	559	do	.....	do	do	do
4145	.....	556	do	.....	do	do	do
4146	.....	556	do	.....	do	do	do
4180	.....	.....	do	.....	do	do	do
.....	.....	.....	do	.....	do	do	do
4175	.....	730	Hell Gate, R. Mts.	.....	do	do	do
4183	.....	728	do	.....	do	do	do
4186	.....	725	do	.....	do	do	do
4187	.....	726	do	.....	do	do	do
4189	.....	723	do	.....	do	do	do
4190	.....	726	do	.....	do	do	do
4192	.....	721	do	.....	do	do	do
4194	.....	727	do	.....	do	do	do
5676	.....	91	Bitter Root River	Aug. 30, 1890	A. Campbell	Dr. J. G. Cooper	do
5673	.....	300	Chilowayook Depot	July 14, 1890	do	Dr. C. B. E. Kennerly	do
5674	.....	426	Camp Kootenay	Aug. 30, 1890	do	do	do
5675	.....	439	do	Aug. 30, 1890	do	do	do
513	.....	.....	St. Mary's, Rocky Mts.	Oct. 1, 1853	Gov. L. I. Stevens	Dr. Geo. Suckley	do
513	1104	.....	do	Oct. 1, 1853	do	do	Skin and skull.
514	1103	.....	do	Oct. 1, 1853	do	do	do
523	.....	.....	Cascade Range	.....	do	do	Skin.
516	.....	.....	Rocky Mountains	.....	do	do	do
3603	3606	.....	Camp Skagit	.....	A. Campbell	Dr. C. B. E. Kennerly	Skull.
5955	5943	.....	Utah	.....	.....	.....	do

TABLE XV.—List of specimens examined of *SCIURUS HUDSONIUS* var. DOUGLASSI.

Catalogue-number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.	Remarks.
4665	.....	43	.....	Fort Crook, Cal.	Oct. 24, 1880	D. F. Parkinson	D. F. Parkinson	Skin	Nearly white below.
4666	.....	.....	.....	do	Oct. 18, 1880	do	do	do	
5895	4786	.....	.....	do	.....	do	do	Skin and skull.	
.....	4754	.....	.....	do	.....	do	do	do	.....
8469	9414	.....	.....	Petaluma, Cal.	.....	E. Samuels	E. Samuels	do	
210	1181	.....	.....	Fort Steilacoom, W. T.	.....	Gov. I. I. Stevens	Dr. Geo. Suckley	do	
380	1974	.....	♀	do	June 15, 1854	do	do	do	"Sk. mounted."
978	.....	.....	♂	do	June 15, 1854	do	do	do	
973	.....	.....	♂	do	June 24, 1854	do	do	do	
974	.....	.....	♂	do	June 24, 1854	do	do	do	"Sk. mounted."
1056	.....	.....	♂	do	Mar. —, 1858	do	do	do	
1077	.....	.....	♂	do	Mar. —, 1858	do	do	do	
1058	.....	.....	♂	do	Mar. —, 1858	do	do	do	.....
1961	.....	.....	.....	do	Mar. —, 1858	do	do	do	
658	.....	.....	.....	do	.....	do	do	do	
.....	8901	.....	.....	do	.....	do	do	Skull	.....
.....	8953	.....	.....	do	.....	do	do	do	
350	.....	.....	.....	do	.....	do	do	do	
1490	.....	.....	.....	Fort Vancouver	Feb. —, 1858	do	do	Skin	"Sk. mounted."
929	1973	.....	♂	do	.....	do	do	do	
811	.....	.....	.....	do	July 30, 1853	do	do	Skin and skull	
88	.....	.....	.....	Astoria	.....	do	do	Skin	.....
3316	.....	111	.....	Columbia River	.....	J. K. Townsend	J. K. Townsend	do	
.....	.....	.....	.....	Simlahmeo, W. T.	.....	Gov. I. I. Stevens	Dr. O. B. E. Kennerly	do	
.....	.....	229	♂	do	.....	do	do	do	.....
3175	.....	38	.....	do	.....	do	do	do	
1167	.....	.....	.....	Cascade Mts., Ore.	Sept. 12, 1858	do	do	do	
.....	.....	.....	.....	do	.....	do	Dr. J. S. Nowberry	do	.....
1184	.....	.....	.....	Upper Des Chutes Valley	.....	do	do	do	
1180	9040	.....	.....	do	.....	do	do	Skin and skull	
1965	2320	.....	.....	do	.....	do	do	do	.....
756	1963	.....	.....	do	.....	do	do	do	

TABLE XVI.—List of specimens examined of SCIURUS HUDSONIUS var. FREMONTI.

Catalogue-number of skin.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.	Remarks.
3314			Bear Creek, Oreg.		Capt. Chas. Bendire	Capt. Chas. Bendire	Skin	
3315			do	Aug. 30, 1876	do	do	do	
3316			do	Aug. 31, 1876	do	do	do	
3419			Fort Crook, Cal.	Mar. 23, 1881	D. L. Parkinson	D. L. Parkinson	do	
3445	337		do		John Fellner	John Fellner	do	
3449	340		do	May 1, 1850	do	do	do	
3477	330		do	May 1, 1850	do	do	do	
9023			Utah Mountains.	July 1, 1889	Clarence King	H. Ridgway	do	
9087	280		do	Sept. 30, 1879	Dr. F. V. Hayden	H. D. Schmidt	do	
9090			do	Sept. 30, 1879	do	do	do	
9096	608		do	Sept. 30, 1879	do	do	do	
9701	569		do	Sept. 25, 1870	do	do	do	
9700	543		do	Sept. 30, 1870	do	do	do	
9009	544		do	Sept. 30, 1870	do	do	do	
9706	606		Rock Creek, W. T.	Oct. 25, 1870	do	do	do	
3709	140		Fort Bridger, Utah	Nov. 8, 1856	Lieut. Ryan	C. S. McCarthy	do	
3708	137		do	Nov. 7, 1856	do	do	do	
3781	138		do	Nov. 9, 1856	do	do	do	
3783	135		do	Nov. 7, 1856	do	do	do	
580			Swatch Pass, R. M.		Capt. E. G. Beckwith	Mr. Krentfeldt	do	
9537			Berthoud's Pass, Col.	July 27, 1889	Dr. F. V. Hayden	J. Stevenson	do	
9541			do	July 27, 1889	do	do	do	
9543			do	July 27, 1889	do	do	do	
9546			do	July 27, 1889	do	do	do	
9543			do	July 27, 1889	do	do	do	
9544			do	July 27, 1889	do	do	do	
9536			Middle Park, Colo.	July 28, 1889	do	do	do	
9545			do	July 28, 1889	do	do	do	
9546			do	July 24, 1889	do	do	do	
9547			do	July 24, 1889	do	do	do	
9539			Soda Springs, Colo.	Aug. 10, 1889	do	do	do	
9540			do	Aug. 10, 1889	do	do	do	
7900	130		Colorado		Chicago Acad. Sci.	Dr. E. B. McCagg	do	
11472			do		Dr. F. V. Hayden	J. H. Baity	do	
11474			do		do	do	do	
11475			do		do	do	do	
11476			do		do	do	do	
11477			do		do	do	do	
11478			do		do	do	do	
11479			do		do	do	do	
11480			do		do	do	do	
11491			do		do	do	do	
11504			do		do	do	do	
11500	170		Twin Lakes, Colo.	Aug. 18, 1873	Lt. G. M. Wheeler	Dr. J. T. Rothrock	do	
11491			do	Aug. 18, 1873	do	do	do	
11497	200		Chimikana Creek, Col.	July 10, 1873	do	do	do	
11478	545		Fort Garland, Colo.	June 4, 1873	do	H. W. Henshaw	do	
11477	547		do	June 3, 1873	do	do	do	
11479	523		do	June 3, 1873	do	do	do	
11479	523		do	June 4, 1873	do	do	do	
3064	716		South Park, Colo.	July, 1871	Rocky Mt. Exped.	Allen and Bennett	do	
3065	731		do	July, 1871	do	do	do	
3066	607		do	July, 1871	do	do	do	

Slightly approaching var. *Auduboni*.

TABLE XVII.—List of specimens of *SCIURUS HUDSONIUS*, grading from var. *HUDSONIUS* into varieties *RICHARDSONI*, *FREMONTI*, and *DOUGLASSI*.

Catalogue number.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.	Remarks.
4278	86	...	Head Gros Ventres Fork.	June 4, 1890	Dr. F. V. Hayden..	Dr. F. V. Hayden..	Skin ..	
4273	...	...	do .....	May 31, 1890	do .....	do .....	do ..	
4274	58	...	do .....	June 3, 1890	do .....	do .....	do ..	
4275	35	...	do .....	May 30, 1890	do .....	do .....	do ..	
4276	53	...	do .....	June 3, 1890	do .....	do .....	do ..	
4277	45	...	do .....	May 30, 1890	do .....	do .....	do ..	
9619	92	...	Yellowstone Lake	July —, 1871	do .....	F. J. Hume ..	do ..	
9618	91	...	do .....	July —, 1871	do .....	do .....	do ..	
9623	94	...	do .....	July —, 1871	do .....	do .....	do ..	Variously intermediate between
9624	95	...	do .....	July —, 1871	do .....	do .....	do ..	vars. <i>hudsonius</i> , <i>richardsoni</i> , and
9617	99	...	do .....	July —, 1871	do .....	do .....	do ..	<i>fremonti</i> .
3683	...	...	Fort Benton, Mont.	do .....	do .....	A. F. Vaughn ..	do ..	
9703	300	...	Piedro Creek, Mont.	do .....	do .....	F. J. Hume ..	do ..	
11107	93	♀	Henry's Fork .....	Aug. 8, 1873	do .....	C. H. Merriam ..	do ..	
11108	90	♀	Firehole River, W. T.	Aug. 17, 1873	do .....	do .....	do ..	
11109	31	♀	Lower Geyser Basin	Aug. 30, 1873	do .....	do .....	do ..	
11113	51	...	Susque River .....	Sept. 17, 1873	do .....	do .....	do ..	
3064	340	♂	Black Hills, Nebr.	Aug. 11, 1857	List. " " Bryan	W. S. Wood ..	do ..	
3034	100	...	do .....	Aug. 10, 1857	do ..	Dr. W. A. Hammond	do ..	
3063	386	♀	Bridger's Pass .....	July 31, 1857	do .....	W. S. Wood ..	do ..	
5896	54	♀	Fort Crook, Cal.	Nov. 3, 1890	D. F. Parkinson..	D. F. Parkinson..	do ..	Intermediate between vars. <i>fremonti</i> and <i>douglasi</i> .
3899	591	♀	Shagitt Valley .....	do .....	A. Campbell ..	Dr. C. B. Kennerly	do ..	
3903	...	...	do .....	do .....	do .....	do .....	do ..	

## SCIURUS CAROLINENSIS Gmelin.

## Gray Squirrel.

## Var. LEUCOTIS.

## Northern Gray Squirrel.

*Sciurus cinereus* SCHREBER, Säuget. iv, 1792, 766, pl. cxxii (nec *S. cinereus* Linn. 1758).—HARLAN, Faun. Amer. 1835, 173.—H. SMITH, Griffith's Cuvier, v, 1827, 254.—FISCHER, Synop. Mam. 1839, 352.—THOMPSON, Hist. Vermont, 1842, 45.—MAXIMILIAN, Wieg. Arch. f. Naturg. 1861, 66.

*Sciurus pennsylvanicus* OUD., "Guthrie's Geogr. (2d Am. ed.) ii, 1815, 292" (dusky phase).

*Sciurus niger* GODMAN, Amer. Nat. Hist. ii, 1826, 133 (melanistic phase) (nec *S. niger* Linn. 1758).—RICHARDSON, Faun. Bor. Amer. i, 1829, 191.—GAPPER, Zool. Journ. v, 1830, 206.—BACHMAN, Proc. Zool. Soc. Lond. 1838, 96; Charlesworth's Mag. Nat. Hist. iii, 1839, 336; Amer. Journ. Sci. and Arts, xxxvii, 1839, 307.—EMMONS, Quad. Mus., 1840, 67.—DEKAY, New York Zool. i, 1842, 60, pl. xvii, fig. 1.—THOMPSON, Hist. Vermont, 1842, 45.—WAGNER, Suppl. Schreber's Säuget. iii, 1843, 172.—SCHINZ, Synop. Mam. ii, 1845, 9.—OUD. & BACHMAN, Quad. N. Amer. i, 1849, 261, pl. xxiv.—MAXIMILIAN, Wieg. Arch. f. Naturg. 1861, 76.—HALL, Canad. Nat. and Geol. 1861, 301.

*Sciurus leucotis* GAPPER, Zool. Journ. v, 1830, 206, pl. xi (based on Canada specimens).—BACHMAN, Proc. Zool. Soc. Lond. 1838, 96; Charlesworth's Mag. Nat. Hist. iii, 1839, 336; Amer. Journ. Sci. and Arts, xxxvii, 1839, 298.—EMMONS, Quad. Mus., 1840, 66.—DEKAY, New York Zool. i, 1842, 57, pl. xvii, fig. 1.—WAGNER, Suppl. Schreber's Säuget. iii, 1843, 160.—SCHINZ, Synop. Mam. ii, 1845, 8.

- Sciurus calpinus* DEKAY, N. Y. Zool. i, 1842, 59 (winter pelage).  
*Sciurus nigratorius* AUDUBON & BACHMAN, Quad. N. Amer. i, 1840, 265, pl. xxxv.—KENNICOTT, U. S. Patent Office Rep. Agricul. for 1856, 1857, 62, pl. vi.—ADAMS, Field and Forest Rambles, 1873, 296 (western and southwestern parts of New Brunswick).  
*Sciurus carolinensis* GODMAN, Amer. Nat. Hist. ii, 1848, 131.—DOUGHTY, Cal. Nat. Hist. ii, 1882, 240, pl. xxi.—BAIRD, Mam. N. Amer., 1857, 256, pl. xlv, fig. 2 (skull) (in part; "larger northern" and "black and dusky" varieties only).—THOMAS, Trans. Ill. State Agricul. Soc. iv, 1860, 656.—HALL, Canad. Nat. and Geol. 1861, 301.—HAYDEN, Trans. Am. Phil. Soc. Phila. xii, 1863, 144.—ALLEN, Bull. Mus. Comp. Zool. i, 1869, 222 (Massachusetts); Proc. Boston Soc. Nat. Hist. xiii, 1870, 189 (Iowa).—GRAY, Ann. and Mag. Nat. Hist. 3d ser. xx, 1867, 426 (vars. "major" et "niger").  
*Sciurus carolinensis* var. *leucotis* ALLEN, Proc. Bost. Soc. Nat. Hist. xvii, 1874, 287.  
*Macrozus melanica* GRAY, Ann. and Mag. Nat. Hist. 3d ser. xx, 1867, 425.

## VAR. CAROLINENSIS.

## Southern Gray Squirrel.

- Sciurus carolinensis* Gmelin, Syst. Nat. i, 1783, 148 (based on Pennant's Lesser Gray Squirrel from Carolina).—M'MURTRIS, M'Murtrie's Cuvier (Am. ed.) i, 1831, 333.—BACHMAN, Proc. Zool. Soc. Lond. 1838, 94; Charlesworth's Mag. Nat. Hist. iii, 1839, 330; Amer. Journ. Sci. and Arts, xxxvii, 1839, 304.—SCHINZ, Synop. Mam. ii, 1845, 8.—AUDUBON & BACHMAN, Quad. N. Amer. i, 1840, 65, pl. vii.—WOODHOUSE, Sitgreaves's Col. and Zuni Riv. Exped. 1853, 62 (Ind. Ter. and Texas).—BAIRD, Mam. N. Amer. 1857, 256 ("small southern variety" only).—SAUSSURE, Rev. et Mag. de Zool. 1861, 3 (Mexico).—TOMES, Proc. Zool. Soc. Lond. 1861, 282 (Guatemala).—GRAY, Ann. and Mag. Nat. Hist. 3d ser. xx, 1867, 426 (var. "minor" only).—ALLEN, Bull. Mus. Comp. Zool. ii, 1871, 176 (Florida).—MAYNARD, Bull. Essex Inst. iv, 1872, 145 (Florida).  
*Sciurus carolinensis* ♀, BAIRD, Mam. N. Amer. 1857, 263 (Santa Catarina, New Leon, Mex.).  
*Sciurus carolinensis* var. *carolinensis* ALLEN, Proc. Bost. Soc. Nat. Hist. xvi, 1874, 287.  
*Sciurus fuliginosus* BACHMAN, Proc. Zool. Soc. Lond. 1838, 96 (dusky phase); Charlesworth's Mag. Nat. Hist. iii, 1839, 300.—WAGNER, Suppl. Schreber's Säuget. iii, 1842, 176.—SCHINZ, Synop. Mam. ii, 1845, 9.—AUDUBON & BACHMAN, Quad. N. Amer. iii, 1852, 240, pl. cxlix, fig. 2.  
*Sciurus deppoi* PETERS, Monatsb. Königl. Preuss. Akad. Wiss. Berlin, 1863 (1864), 654.  
*Lesser Gray Squirrel*, PENNANT, Synop. Quad. 1771, 283.  
*Écureuil gris de la Caroline*, F. CUVIER, Hist. des Mamm. i, livr. —, 1819 (plate and text).

## VAR. LEUCOTIS.

## Northern Gray Squirrel.

VARIETAL CHARs.—Length of body about 10.50 inches, varying from 9 to 11.50; tail-vertebræ 8, varying from 7 to 9; tail to end of hairs 11.50, varying from about 10 to 12.50. Above, whitish-gray, with a dorsal area and a lateral line brownish-yellow, and with a more or less strong fulvous suffusion beneath the surface of the pelage, generally more or less apparent through the surface-tints; beneath, white. Varies through dusky and annulated phases to intense glossy black; rarely, in the dusky phases, with areas of yellowish-brown below, more or less strongly annulated with black. Tail with the hairs yellowish-brown basally, with narrow black annulations, and a broad, conspicuous, subterminal black bar, the hairs all broadly tipped with white, giving a white surface-tint, through which the yellowish-brown and black bars are seen beneath. Ears not tufted, with or without a conspicuous woolly tuft of white at the base posteriorly.

The Northern Gray Squirrel varies greatly, aside from its melanistic phases, in specimens from the same locality, mainly in respect to the amount of the fulvous suffusion in the pelage of the dorsal aspect. The general color above is a fine mixture of white, black, and fulvous, variable in respect to the relative prevalence of these three tints. The general effect is that of a whitish-gray tint, especially northward and in winter specimens. There is generally a well-marked yellowish-brown area, almost unmixed with whitish, along the middle of the back, sometimes continuous from the nape to the rump, but generally restricted to the middle of the dorsal region. This is often wholly obsolete, but generally occupies an area of two or three inches in length, with a breadth of rather less than an inch. The hairs of the dorsal surface are generally ringed with white, black, and fulvous, but some are wholly black and others wholly fulvous. The fulvous under-color generally shows more or less strongly through the superficial tints, especially on the sides of the shoulders, where it sometimes inclines to rufous. There is generally a well-developed yellowish lateral line separating the white of the lower parts from the gray of the upper surface. This varies in intensity, and, although present as a rule, I find no trace of it in many New England specimens. The head is often of the same yellowish-brown as the middle of the back, but more commonly less strongly brownish; the sides of the nose and cheeks vary from grayish, with a faint wash of fulvous, to strongly yellowish-brown. The upper surface of the feet also varies in the same manner from whitish-gray to bright fulvous. The yellowish-brown at the base of the tail-hairs also varies from pale fulvous-brown to yellowish-rusty. Specimens in which there is a large, conspicuous, brownish area on the middle of the back have usually the yellowish lateral line strongly developed, with fulvous feet, face, and ears. The ears are generally fulvous-tipped, with a white or yellowish-white woolly patch at the base, generally far more strongly developed in winter than at other seasons, it being often quite absent in summer. This white fluffy ear-patch is most conspicuous in winter specimens from Fort Des Moines, Iowa. In these also, the pelage is the softest and fullest.

The dusky phases of this variety are local in their occurrence, being often wholly unknown over wide areas. They are found in South-western New Brunswick, in portions of Maine, New Hampshire, Vermont, Massachusetts, New York, both the Canadas, in all of the Lake States, and in . . . but more frequently near the lakes than further southward.

Professor Baird says they are rare in Eastern Pennsylvania, Maryland, and Virginia. At localities where the pure black phase occurs can usually be found every intermediate stage between the intensely glossy black individuals and those which scarcely differ from the ordinary type. In Western New York and Northeastern Illinois, where I have had the opportunity of observing the two phases in life, I found that those representing the dusky, annulated phase of coloration were young animals, while all the intensely black ones were evidently aged. I felt at the time strongly inclined to the opinion that only the fully mature become intensely black,—in other words, that the intensity of the black increased with age, and that the black Squirrels when young were all more or less annulated with rusty.

A series before me presents a gradual transition from the usual gray type to the pure black phase. No. 1130 (Fort Des Moines, Iowa, Dec., 1855) differs but little above from the usual gray form, except in having a rather stronger suffusion of rufous and less white; the sides are more strongly reddish-fulvous, and the white area of the ventral surface is narrow and of a rather dingy white, with the breast strongly ochraceous. No. 1136 (♀, same locality and season) has still less gray above, the brownish suffusion is still stronger, and the white of the ventral surface is restricted to a few irregular patches, more or less confluent. There are dusky areas around the teats; the throat and upper part of the breast are mixed yellowish-brown and black; the inside of the limbs and lower part of the breast are washed with yellowish-rufous or gamboge, strongest on the inside of the thighs. No. 1636 (Coll. M. C. Z., from Wayne County, Ill., Sept., 1867) differs from the last mainly in having the middle of the belly grayish-white, mixed along the median line with pale rufous hairs annulated with dusky; the breast and sides of the abdomen are washed with dingy yellowish-brown. No. 970 (West Northfield, Ill., Sept., 1855) has the lower parts with a small whitish area divided medially by bright yellowish-brown, the rest of the lower surface being gamboge-yellow. The sides of the back from the middle of the body posteriorly are strongly whitish-gray, in strong contrast with the rest of the dorsal surface, while the chin, lips, and edges of the fore feet are deep reddish-chestnut mixed with blackish. Next come a considerable series of specimens, obtained in 1847 by Professor Agassiz from the Boston markets, and probably killed either in New England or New York, that show various stages of intergradation between the three specimens last described and those



that are pure glossy black throughout. No. 1499 (Coll. M. C. Z.) has the upper surface dusky, varied with pale yellowish-brown, especially anteriorly and on the sides; beneath, yellowish-rufous, more or less varied with black. No. 1496 (Coll. M. C. Z.) is blacker above, with the lower parts dusky, annulated with yellowish-brown, the two colors being in about equal proportions. Several other specimens from the same lot differ only in being sometimes more and sometimes less varied with pale yellowish-brown above, and in the greater or less amount of dusky below. Other specimens, from Wayne County, New York, and from Cook County, Illinois, are almost precisely similar, though each, on close inspection, is found to vary more or less, in some feature or another, from all of the others. No. 1057 (Cook Co., Ill., Nov., 1855) is glossy black above, sparsely varied with gamboge on the sides and below, forming the last stage in the transition to those which are glossy black throughout.

Var. CAROLINENSIS.

*Southern Gray Squirrel.*

VARIETAL CHAR.—Length of body about 9.50 inches, ranging from 8.50 to 10.25; tail-vertebræ about 8.00, ranging from 7.50 to 8.75; tail to end of hairs about 10.50, ranging from 9.00 to 11.50. Above, brownish-yellow, varied with black, with generally the sides of the neck, shoulders, and thighs mixed with whitish; beneath, white. Differs from var. *leucotis* in its smaller size, and in the general color of the dorsal surface being yellowish-brown instead of whitish-gray. In the majority of specimens, the white-tipped hairs that in var. *leucotis* give a whitish aspect to the whole dorsal surface (excepting over a restricted central area) are either wholly wanting in var. *carolinensis* or give merely a faint grayish cast to the sides of the neck, the shoulders, and thighs. In other words, the fulvous suffusion that pervades the pelage beneath the surface in var. *leucotis* reaches the surface in var. *carolinensis*, thereby displacing the superficial white tint seen in var. *leucotis*. The transition in color is evidently effected by the extension of the limited brownish dorsal area usually seen in var. *leucotis* till it occupies the whole of the dorsal surface, accompanied with an increase in the intensity of the tint. The general color above of var. *carolinensis* is mixed yellowish-brown and black, instead of white, black, and yellowish-brown, with white for the prevalent tint, as in *leucotis*.

The form above characterized as var. *carolinensis* is typically represented by Florida specimens. Specimens from Louisiana, however, are hardly distinguishable from Florida ones. A specimen from Salt Creek, Kansas (No. 3061, May 29, 1857), is not appreciably different. Specimens from the Carolinas, and as far north even on the coast as Washington, and as far north in the Mississippi Valley as Saint Louis, are nearer the southern form than they are to the northern.

Var. YUCATANENSIS, n. v.

*Yucatan Gray Squirrel.*

VARIETAL CHARs.—Size small; tail with hairs shorter than head and body. Intermediate in size between *S. carolinensis* (var. *carolinensis*) and *S. hudsonius*. Head and body 10.00; tail-vertebræ 8.00; tail to end of hairs 9.75. Ears narrow and pointed, in winter somewhat tufted. Pelage coarse and harsh. Above, gray, with the middle of the back brownish; beneath, white; hairs of the tail ringed with white and black.

The four specimens of this variety before me are all from Merida, Yucatan, and were collected by Dr. A. Schott in March, 1865. They present a remarkable degree of uniformity in coloration. Three are adult, the other about half-grown. Their general aspect is widely different from that of any form of *S. carolinensis* from the United States, but differs less from the New Leon specimens, referred doubtfully by Baird, in 1857, to *S. carolinensis*. The pelage is very coarse, harsh, and stiff; the sides are clear ashy-gray, unvaried with any shade of fulvous or rufous. The middle of the dorsal region is black and light yellowish-brown, the hairs being black at base and tip, with a broad subterminal bar of wood-brown. The tail is centrally white below, with a well-defined line of black on either side of the median line, traversing the middle of the basal white band; on either side of the central white area is a broad bar of black, succeeded by a broad terminal bar of white. Each hair is thus white, with an inner narrow bar of black and a broader outer one of the same color, with no shade of fulvous or rufous. The ears are much narrower and higher than in any United States form of *carolinensis*, and, with the coarse pelage, ashy-gray tints of the sides, and blackish hue of the back, varied with pale yellowish-brown, together with the small size, convey the impression of an animal specifically distinct from any other species of *Sciurus*, and I am far from sure that it should not be so

regarded. The measurements given beyond are taken from the skins, and seem to indicate a form nearly as large as the *S. carolinensis* from the South Atlantic and Gulf States; yet, on comparison of specimens, the feet of the Merida specimens prove to be much smaller, the head narrower and every way smaller, showing in reality a much smaller animal, not much exceeding in size *S. hudsonius*. The New Leon specimens, however, are fairly intermediate, lacking the fulvous tint of the sides seen in northern specimens, and in general color and character of the pelage considerably approach the Merida examples.

De Saussure describes *S. carolinensis* as a Mexican species, and Tomes gives it as inhabiting Guatemala. De Saussure's description indicates an animal not very different from the northern *S. carolinensis*, including the fulvescent sides and centrally rufous tail. The "cauda corpore vix brevior" and the size show the animal is not referable to *S. colliei*. This seems to indicate the extension southward of the habitat of *S. carolinensis* throughout Mexico to Yucatan and Guatemala, its range southward being thus coextensive with that of *Lepus sylvaticus*, *L. palustris*, and *L. aquaticus*.

#### GENERAL REMARKS ON *SCIURUS CAROLINENSIS* AND ITS VARIETIES.

**DIFFERENTIAL CHARACTERS.**—Vars. *leucotis* and *carolinensis* cannot of course be trenchantly defined. On comparing specimens from New England with others from Florida, representing, of course, the extremes of variation, the differences between the two, both in color and size, are very striking; but, in passing southward from Massachusetts to Florida, this wide difference is found to be effected by gradual and imperceptible steps. In New England specimens, a large proportion are wholly without a central dorsal area of brown; in Pennsylvania, Ohio, Illinois, and Iowa specimens, it is a pretty constant feature, varying greatly, however, in extent with different individuals. In Eastern Pennsylvania and Maryland specimens, this brownish dorsal area becomes more extended, but the sides of the body, and generally the rump, are still strongly washed with whitish. Carolina specimens, especially from the coast region, strongly approach the Florida ones. The few specimens before me from the Gulf States render it probable that the form existing there differs little from the extreme phase of *carolinensis* as developed in Florida. The variation in size is equally gradual, consisting of a decrease in size southward. The dividing line between the habitats of the two forms may perhaps be

considered as the vicinity of the Potomac River on the Atlantic coast. Probably var. *leucotis* occurs southward in the mountains to Georgia, while again, in the Mississippi Valley, the southern boundary of its habitat sweeps northward as far as Southern Illinois. Along the Atlantic coast, no melanistic phase of var. *carolinensis* has as yet been reported, but in Louisiana and northward along the Mississippi a melanistic phase has been said to occur, forming the *S. fuliginosus* of Bachman.

**GEOGRAPHICAL DISTRIBUTION**—The present species ranges eastward along the Atlantic coast to New Brunswick, and is found thence westward over the southern half of Maine, most parts of Vermont, New Hampshire, and New York, most of the Saint Lawrence Valley, the southern portions of Canada, Michigan,\* Wisconsin, Iowa, and up the Missouri, at least to the mouth of the Platte, and thence everywhere southward to the Gulf coast. It ranges westward to the eastern border of the Plains, from Nebraska to Texas, and apparently far into Mexico. Its northern limit of distribution coincides very nearly with the northern boundary of the Alleghanian fauna, and hence very nearly with the isotherm of 44° F. Variety *leucotis* may be considered as ranging southward over both the Alleghanian and Carolinian faunæ, or about to the isotherm of 56° F., where vars. *leucotis* and *carolinensis* become not readily distinguishable. Var. *carolinensis* occupies the region thence southward, in the United States, to the Gulf coast, and also far into Mexico, and even apparently to Guatemala.

In the United States, it has not been reported from any locality west of the eastern edge of the Plains or west of Texas. The specimens from New Leon, Mexico, are the most southern I have seen, and depart somewhat from any of the forms met with in the United States. The descriptions of *S. carolinensis*, from Mexican specimens, seem unquestionably referable to this species, and seem to indicate that the form met with in Central and Southern Mexico is not greatly different from the form occurring in the middle portions of the United States, though referred to as smaller and more fulvous.

The form I have characterized above as var. *yucatanensis* is possibly specifically distinct, but, if so, has very close affinities with the New Leon type of *S. carolinensis*. The four specimens of this form in the collection are all from Merida, Yucatan. I have met with no description that is at all referable to this form, and can hence add nothing further respecting its range.

\* Richardson refers to the occurrence of the black form on the northern shores of Lakes Huron and Superior, and gives its range as extending northward to the fiftieth parallel.—(*Fawn. Bor.-Amer.* vol. 1, 1823, p. 191.)

**GEOGRAPHICAL VARIATION.**—The principal features of geographical variation presented by this species have already been described in characterizing the three varieties *leucotis*, *carolinensis*, and *yucatanensis*, they consisting mainly in decrease in size southward and an increase in intensity of coloration, the whitish tips of the hairs of the dorsal surface seen in northern specimens being replaced by yellowish-brown in the southern ones, except in the case of var. *yucatanensis*. As happens, however, in numerous other instances, the largest size is not reached on the Atlantic coast, but far in the interior, toward the Upper Missouri country. Although not ranging much above the Platte, the same influences are present, generally in less degree, in Wisconsin and Iowa. Thus, a series of seven specimens from Fort Des Moines, Iowa, average 11 inches in length of body, while a similar series from the vicinity of Chicago, Ill., fall below 10.50. A series of eleven from the vicinity of Washington scarcely reach 10.00, while Florida specimens average only about 9.50. In respect to the Atlantic coast region, few adult skulls from north of Washington, D. C., fall below 2.40 in length, ranging from 2.35 to 2.52, while of six skulls from the Gulf States, only one reaches 2.30, the average being about 2.25.

Aside from the variation in color with locality already mentioned, specimens from New England and Pennsylvania can generally be easily distinguished from those from west of the Alleghanies, especially from Ohio, Illinois, and Iowa specimens, the former being of a clearer or whiter gray than those from corresponding latitudes in the West. Specimens from Northeastern Mexico are less suffused with fulvous than United States specimens, while a still grayer type occurs in Yucatan. As already noted, in Southern Mexico the species maintains the feature of excessive fulvous suffusion met with in the United States.

**SYNONYMY AND NOMENCLATURE.**—The earliest available specific name for this species is *carolinensis*, given by Gmelin, in 1788, to Pennant's "Lesser Gray Squirrel" of Carolina. Pennant's "Quadrupeds" is the only work cited, and the habitat is distinctly given as Carolina. In separating the species into northern and southern races, *carolinensis* must of course be retained as the varietal name of the southern form. In 1792, Schreber renamed the species *cinereus*, his description being based on specimens from New York, hence referring to the northern variety. The name, however, was preoccupied, having been previously given by Linnæus to the Fox Squirrel. Many

writers have, notwithstanding, applied the name *cinereus* to the present species. According to Professor Baird, Ord, in 1815, gave the name *pennsylvanicus* to the black variety of the Gray Squirrel, though Godman\* and subsequent authors have often applied to it the name *niger*, long previously given by Linnaeus to the black phase of the Fox Squirrel. Gapper, in 1830, gave the name *leucotis* to Canadian specimens of the common gray form. This name I adopt for the northern variety, from its being exclusively applicable to the northern form. While *pennsylvanicus* of Ord has fifteen years' priority over this name, it was given to specimens from the Middle Atlantic States, and hence from a locality bordering upon the habitat of the southern form, and consequently the name is not strictly applicable to the northern type as developed in the Northern and Northeastern States and the Canadas. Audubon and Bachman, not liking the name *leucotis* of Gapper, proposed, some twenty years later, to substitute for it the name *migratorius* as being one far more appropriate for the Northern Gray Squirrel. Dr. Bachman had previously regarded the Northern and Southern Gray Squirrels as distinct species, restricting the name *carolinensis* to the southern form. The name *fuliginosus* of Bachman apparently refers to a dusky phase of the southern form, supposed by him to be more or less common along the lower part of the Mississippi, especially in Louisiana. I have met thus far with no melanistic specimens of the Gray Squirrel from any point south of Pennsylvania, nor have I found any other reference to anything that can be considered as a melanistic phase of the southern variety. The specimens from New Leon, Mexico, referred very doubtfully by Professor Baird to *Sciurus carolinensis*, seem not to be varietyally distinguishable from the southern form of this species, and are hence here identified as referable to var. *carolinensis*.

The *Sciurus carolinensis* of De Saussure from Mexico seems not to differ materially from *S. carolinensis* of the United States. "Cauda corpore vix brevior. Supra fuscus, flavo dense tessellatus; dorso medio obscuriore, lateribus flavescentibus", etc., applies unequivocally to *S. carolinensis*, and to no other species thus far known to me. Tomes gives it from Dueñas, Guate-

\* Richardson (Faun.-Bor. Amer. 1, 191) cites "*Sciurus niger* Say, Long's Expedition, vol. 1, p. 262", probably from the English edition, which is the one he elsewhere says he usually quotes. In the American edition, in the "Catalogue of the Names of Animals" met with at and on the journey to Engineer Cantonment (vol. 1, p. 376), occurs "*Sciurus nigra*—Black Squirrel", but with no further remarks, and hence nothing to indicate the locality of its occurrence, or whether the "Black Squirrel" here referred to is *S. carolinensis* or a melanistic phase of one of the Fox Squirrels. In the same manner are mentioned "*Sciurus capistratus*" and "*Sciurus cinereus*".

mala, remarking that the Guatemala specimens "differ from the ordinary specimens of *S. carolinensis* in being smaller and much more strongly tinged with brown or rufous. There are not sufficient grounds, however, for regarding them as distinct from that species, the differences being such as we might expect to meet with." I have not, however, met with any specimens of this species from Mexico, notwithstanding the large number of Mexican Squirrels I have had the opportunity of examining.

The *Sciurus deppei* of Peters clearly belongs to this group, as shown by its size, the length of the tail (with the hairs shorter than the body), and coloration. The locality is given as "Papatla, Mexico," and the supposed species is here doubtfully referred to the southern form of *S. carolinensis*.

TABLE XVIII.—Measurements of twenty-eight specimens of *SCIURUS CAROLINENSIS* var. *LEUCOTIS*.

Catalogue-number.	Locality.	From tip of nose to—				Tail to end of—			Length of—		Nature of specimen.	Remarks.
		Sex.	Eye.	Ear.	Occiput.	Tail.	Vertebrae.	Hairs.	Fore foot.	Hind foot.		
1181	Fort Des Moines, Iowa	..	..	..	..	11.25	9.00	11.50	.....	2.70	Skin	
1206	do	♂	..	..	..	11.00	7.00	10.50	.....	2.70	do	
1227	do	♀	..	..	..	10.50	8.00	11.00	.....	2.45	do	
1130	do	..	..	..	..	11.50	7.00	9.50	.....	2.70	do	
1131	do	..	..	..	..	11.00	..	..	.....	2.80	do	
1134	do	..	..	..	..	11.00	..	..	.....	2.50	do	
1135	do	..	..	..	..	10.50	..	..	.....	2.65	do	
1276	Racine, Wis.	..	..	..	..	11.00	7.00	10.00	.....	2.40	do	
334	do	..	..	..	..	10.00	8.25	11.00	.....	2.65	do	
256	do	..	..	..	..	10.00	7.50	11.00	.....	..	do	
979	West Northfield, Ill.	♀	..	..	..	10.25	8.00	11.00	.....	2.65	do	
1057	do	..	..	..	..	8.00	7.00	10.00	.....	2.40	do	
780	do	..	..	..	..	10.35	9.25	12.25	.....	2.60	do	
791	do	..	..	..	..	10.50	9.00	12.50	.....	2.75	do	
970	do	♀	..	..	..	10.00	8.00	11.00	.....	2.50	do	
178	Detroit, Mich.	♀	..	..	..	11.00	9.00	11.00	.....	2.55	do	
161	Cleveland, Ohio	..	..	..	..	10.00	9.50	12.00	.....	2.50	do	
..	Washington, D. C.	..	1.17	2.17	2.68	10.25	7.50	10.50	1.75	2.50	Fresh	
..	do	..	..	..	2.50	9.00	8.50	11.33	1.75	2.50	do	
485	do	♂	..	..	..	10.50	..	..	..	2.65	Dry skin	
486	do	♂	..	..	..	10.50	..	..	..	2.60	do	
378	do	..	..	..	..	9.00	8.00	10.00	..	2.50	do	
907	do	♂	..	..	2.50	10.00	8.00	11.00	..	2.30	do	
1293	do	♂	..	..	..	10.50	..	..	..	2.60	do	
1273	do	..	..	..	2.40	11.00	..	11.00	..	2.50	Alco skin	
2574	do	..	..	..	2.50	10.00	..	11.25	..	2.55	do	
2375	do	..	..	..	2.70	10.00	8.00	10.75	..	2.50	Alcoholic	
2361	do	..	..	..	2.35	9.00	8.00	10.50	..	2.50	do	

Measurements from  
Baird's Mamm.  
N. America, pp.  
262, 263.



SCIURIDÆ—SCIURUS CAROLINENSIS VAR. YUCATANENSIS. 711

TABLE XIX.—Measurements of thirty-six specimens of SCIURUS CAROLINENSIS var. CAROLINENSIS.\*

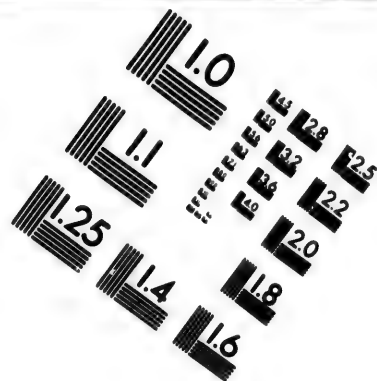
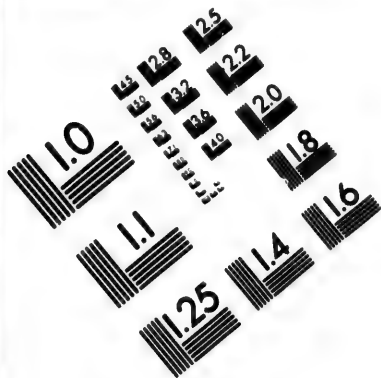
Catalogue number.	Original number.	Locality.	Sex.	From tip of nose to—		Tail to end of—		Length of—		Nature of specimen.
				Occiput.	Tail.	Vertebra.	Hairs.	Fore foot.	Hind foot.	
9453	800	Jacksonville, Fla.	♂	2.50	8.00	8.00	11.00	.....	2.45	Fresh.
9454	806	.....do.....	♀	2.40	8.00	7.75	10.45	1.35	2.35	..do.
9455	807	.....do.....	♀	2.45	8.45	7.50	10.25	1.45	2.45	..do.
5040	321	.....do.....	♀	.....	8.50	7.50	10.00	.....	.....	..do.
9441	328	.....do.....	♂	.....	10.50	7.50	10.00	.....	.....	..do.
501	581	Dunnell's, Fla.	♀	2.45	8.50	8.15	10.50	1.60	2.56	..do.
502	582	.....do.....	♂	2.55	10.30	8.00	10.56	1.35	2.40	..do.
9454	343	Wetaka, Fla.	♂	.....	10.00	8.25	11.00	.....	.....	..do.
9455	344	.....do.....	♀	.....	10.00	8.75	11.50	.....	.....	..do.
9456	347	.....do.....	♂	.....	12.00	8.40	9.00	.....	.....	..do.
9457	348	.....do.....	♂	.....	9.00	7.50	10.00	.....	.....	..do.
9458	349	.....do.....	♀	.....	9.15	7.60	9.85	.....	.....	..do.
9459	370	.....do.....	♀	.....	10.15	9.60	11.35	.....	.....	..do.
9464	377	Hawkinsville, Fla.	♂	2.40	9.50	8.00	10.50	1.50	2.15	..do.
9467	378	.....do.....	♂	2.44	9.25	8.00	9.25	1.60	2.25	..do.
.....	379	.....do.....	♀	2.33	8.25	8.75	11.00	1.35	2.29	..do.
.....	380	.....do.....	♀	2.50	9.25	8.00	9.75	1.40	2.30	..do.
.....	381	.....do.....	♀	2.45	8.75	7.60	10.00	1.50	2.25	..do.
9468	382	.....do.....	♀	2.35	8.90	7.80	10.60	1.50	2.05	..do.
.....	394	.....do.....	♂	2.45	9.00	7.60	10.00	1.50	2.25	..do.
.....	395	.....do.....	♂	2.30	9.50	6.75	9.00	1.40	2.50	..do.
.....	396	.....do.....	♀	2.35	8.75	8.00	10.00	1.40	2.15	..do.
.....	397	.....do.....	♂	2.45	9.00	8.50	10.75	1.45	2.30	..do.
.....	398	.....do.....	♂	2.50	10.00	8.00	10.50	1.45	2.37	..do.
.....	399	.....do.....	♂	2.35	8.75	8.00	11.00	1.42	2.25	..do.
.....	400	.....do.....	♂	2.40	9.00	8.00	10.25	1.45	2.28	..do.
.....	401	.....do.....	♂	2.35	9.25	7.05	9.75	1.44	2.30	..do.
.....	428	.....do.....	♂	2.40	9.00	7.50	9.50	1.45	2.39	..do.
.....	393	.....do.....	♂	2.40	9.15	7.85	10.10	1.45	2.28	..do.
.....	394	.....do.....	♂	2.38	9.25	8.15	10.75	1.45	2.30	..do.
.....	395	.....do.....	♂	2.40	9.00	7.90	10.50	1.50	2.40	..do.
.....	396	.....do.....	♂	2.50	9.75	8.15	10.25	1.55	2.35	..do.
.....	397	.....do.....	♂	2.40	9.00	7.75	10.25	1.40	2.30	..do.
.....	398	.....do.....	♂	2.40	9.75	7.95	9.60	1.55	2.30	..do.
.....	399	.....do.....	♂	2.50	10.15	7.65	10.35	1.65	2.45	..do.
.....	400	.....do.....	♂	2.40	8.90	7.35	10.10	1.60	2.15	..do.

\* The measurements given in this table were all taken from specimens in the flesh and were nearly all made by myself in the field. They are here quoted from my "Mammals and Winter Birds of East Florida". (See Bull. Mus. Comp. Zool. vol. 11, p. 177.)

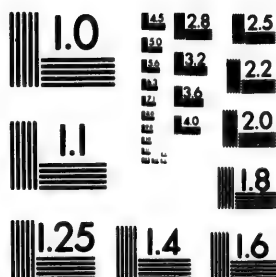
TABLE XX.—Measurements of three specimens of SCIURUS CAROLINENSIS var. YUCATANENSIS.

Catalogue number.	Original number.	Locality.	Sex.	From tip of nose to—				Tail to end of—		Length of—		Height of ear.	Nature of specimen.
				Eyes.	Ears.	Occiput.	Tail.	Vertebra.	Hairs.	Fore foot.	Hind foot.		
5002	820	Merida, Yucatan	♂	0.83	1.45	1.95	10.00	7.25	9.25	1.25	2.05	0.50	Skin.
5005	808	.....do.....	♂	0.80	1.70	2.00	9.00	7.50	9.70	1.25	1.95	0.61	..do.
5003	809	.....do.....	♀	0.80	1.80	2.05	10.50	8.50	10.50	1.30	2.10	0.56	..do.





# **IMAGE EVALUATION TEST TARGET (MT-3)**



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2.8  
2.5  
2.2  
2.0

10



TABLE XXIII.—List of specimens examined of SCIURUS CAROLINENSIS var. LEUCOTIS.

Catalogue-number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.	Remarks.
*1101				Amherst, N. H.		S. H. Mollady	S. H. Mollady	Alcoholic	
*1494				Calais, Me.		G. A. Boardman	G. A. Boardman	Skin	
*1495				do		do	do	do	
*3006				Upton, Me.		J. G. Rich	J. G. Rich	Alcoholic	
*1319				Norway, Me.		B. D. Verrill	B. D. Verrill	Skin	
*3081				do		do	do	Alcoholic	
*1313				Massachusetts		L. Agassiz	L. Agassiz	Skin	
*1314				do		do	do	do	
*1315				do		do	do	do	
*1316				do		do	do	do	
*1317				do		do	do	do	
*1318				do		do	do	do	
*1319				do		do	do	do	
*1320				do		do	do	do	
*1301				do		do	do	do	
*1302				do		do	do	do	
*1303				do		do	do	do	
*1304				do		do	do	do	
*1305				do		do	do	do	
*1306				do		do	do	do	
*1307				do		do	do	do	
*1308				do		do	do	do	
*1309				do		do	do	do	
*1496				do		do	do	do	
*1497				do		do	do	do	Blackish.
*1498				do		do	do	do	
*9490				Watertown, Mass.		C. J. Maynard	C. J. Maynard	do	
*2543				Newtonville, Mass.		do	do	do	
*140				Concord, Mass.	June 24, 1893	H. Mann	H. Mann	Alcoholic	
*200				Worthington, Mass.		W. H. Miles	W. H. Miles	do	
*201				Saint Lawrence County, N. Y.		J. S. Foley	J. S. Foley	do	
906				Middleboro', Mass.	Oct. 27, 1893	J. W. P. Jenks	J. W. P. Jenks	Skin	
1437				do	Spring, 1896	do	do	do	
96				Carlisle, Pa.		S. F. Baird	S. F. Baird	do	
1679				do	Sept. 5, 1896	do	do	do	
7207			♀	Allegheny Co., Pa.		R. L. Walker	R. L. Walker	do	
4674				Pennsylvania?		Maj. Le Conte	Maj. Le Conte	do	Black, annulated below.
.....				Greensburg, Pa.		F. Cowan	F. Cowan	Skull	
.....				do		do	do	do	
.....				do		do	do	do	
.....				do		do	do	do	
.....			♀	do		do	do	do	
.....			♀	do		do	do	do	
.....			♀	do		do	do	do	
.....			♂	do		do	do	do	
4337				Chesler Us., Pa.		Dr. E. Miehner	Dr. E. Miehner	do	
4230				do		do	do	do	
.....				Carlisle, Pa.		S. F. Baird	S. F. Baird	do	
9694				do		do	do	do	
2150				do		do	do	do	

\* In Museum of Comparative Zoology, Cambridge, Mass.

TABLE XXIII.—List of specimens examined of *SCIURUS CAROLINENSIS* var. *LEUCOTIS*—Continued.

Catalogue-number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.	Remarks.
4734				Pennsylvania?		Nat'l Gallery.		Skull.	
987	1853		♂	Washington, D. C.	Oct. 23, 1855	S. F. Baird	S. F. Baird	Skull and skull	
465			♂	do	Jan. 31, 1855	do	do	Skin	
496			♂	do	Jan. 31, 1855	do	do	do	
1293	9005		♂	do	Winter, 1856	do	do	Skin and skull	
5642			♂	do			C. Drexler	Skin	
5646			♂	do			J. E. Townsend	do	
380			♂	do	Nov. —, 1854		M. McDonald	do	
5794			♂	do				do	
1006			♂	do		S. F. Baird	S. F. Baird	Skull	
1627			♂	do		do	do	do	
9237			♂	do		do	do	do	
7097			♂	do		do	do	do	
100			♂	Cleveland, Ohio		J. P. Kirtland	J. P. Kirtland	Skin	
181			♂	Rockport, Ohio		do	do	do	
180			♂	do		do	do	do	
6116			♂	Mount Carroll, Ill.	Oct. 26, 1864	R. Kennicott	R. Kennicott	do	
960			♂	Union County, Ill.	Sept. —, 1855	do	do	do	
970			♂	West Northfield, Ill.	Sept. 25, 1855	do	do	do	
978			♂	do	Sept. —, 1855	do	do	do	Black.
730			♂	do	Spring, 1855	do	do	do	Dusky, annulated above and below.
731			♂	do	Spring, 1855	do	do	do	
732			♂	do	Spring, 1855	do	do	do	
733			♂	do	Spring, 1855	do	do	do	
734			♂	do	Spring, 1855	do	do	do	
735			♂	do	Spring, 1855	do	do	do	
736			♂	do	Spring, 1855	do	do	do	
737			♂	do	Spring, 1855	do	do	do	
738			♂	do	Spring, 1855	do	do	do	Dusky.
739			♂	do	Spring, 1855	do	do	do	do.
907			♂	Cleveland, Ohio		S. F. Baird	S. F. Baird	Skull	Black.
1057			♂	Chicago, Ill.		R. Kennicott	R. Kennicott	Skin	do.
1361			♂	do		do	do	do	Gray.
177	1866		♂	Grosse Ile, Mich.		C. Fox	C. Fox	Skin and skull	Black.
183			♂	Detroit, Mich.		do	do	Skin	Black.
176			♀	do		do	do	do	Black.
964			♀	Racine, Wis.		Dr. F. E. Hoy	Dr. F. E. Hoy	do	
1976			♀	do		do	do	do	
956			♀	do		do	do	do	
927			♀	do		do	do	do	
327			♀	do		do	do	do	
330			♀	do		do	do	do	
331			♀	do		do	do	do	
1800			♀	do		S. F. Baird	S. F. Baird	Skull	
1809			♀	do		do	do	do	
1850			♀	do		A. C. Barry	A. C. Barry	do	
1851			♀	do		do	do	do	
1156			♂	Fort Des Moines, Iowa	—, 1855	W. E. Moore	W. E. Moore	Skin	
1167			♀	do	—, 1855	do	do	do	
1168			♀	do	—, 1855	do	do	do	

SCIURIDÆ—SCIURUS CAROLINENSIS VAR. CAROLINENSIS. 715

TABLE XXIII.—List of specimens examined of SCIURUS CAROLINENSIS var. LEUCOTIS—Continued.

Catalogue-number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.	Remarks.
1189				Fort Des Moines, Iowa.	Dec. —, 1893	W. E. Moore.	W. E. Moore.	Skin	
1190				do	Dec. —, 1893	do	do	do	
1191				do	Dec. —, 1893	do	do	do	
1192			♂	do	Dec. —, 1893	do	do	do	
1193				do	Dec. —, 1893	do	do	do	
1194	3146			do	Dec. —, 1893	do	do	Skin and skull.	
1195				do	Dec. —, 1893	do	do	Skin	
1196			♀	do	Dec. —, 1893	do	do	do	
1904			♂	Saint Louis, Mo.		Dr. Geo. Engelmann.	Dr. Geo. Engelmann.	do	
1905			♂	do		do	do	do	
3100			♀	Independence, Mo.		Dr. J. G. Cooper.	Dr. J. G. Cooper.	do	
301				Missouri		Dr. F. E. Hoy.	Dr. F. E. Hoy.	do	
302				do		do	do	do	
1944				do		do	do	Skull	
715			♂	Leavenworth, Mo.	Jan. 26, 1895	La. D. H. Couch.	La. D. H. Couch.	do	
3090	197			Salt Creek, Kans.	May 25, 1897	La. F. T. Bryan.	W. S. Wood.	do	
3091	100			do	May 25, 1897	do	do	do	
3093	100			do	May 25, 1897	do	do	do	
1497				Mouth of Platte.	Apr. 25, 1897	do	do	do	

TABLE XXIV.—List of specimens examined of SCIURUS CAROLINENSIS var. CAROLINENSIS.

Catalogue-number of skin.	Corresponding number of skull.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.	Remarks.
9054		♀	Columbia, S. C.		Dr. E. Coues.	Dr. E. Coues.	Skin	In Nat. Museum.
9055		♂	do		do	do	do	do
9056		♀	do		do	do	do	do
9057		♀	do		do	do	do	do
9058			do		do	do	do	do
9059			do		do	do	do	do
1377			Tarboro', N. C.		J. L. Bridger.	J. L. Bridger.	do	do
1378			do		do	do	do	do
1379			do		do	do	do	do
318			Charleston, S. C.		F. S. Holmes.	F. S. Holmes.	do	do
			Liberty County, Ga.	May —, 1894	Maj. J. Leconte.	Maj. J. Leconte.	Skull	do
3090			Georgia.		Dr. Jones.	Dr. Jones.	do	do
4751			Grand Oleen, La.		St. Charles College.	St. Charles College.	Skin	do
4790			do		do	do	do	do
4791			do		do	do	do	do

TABLE XXIV.—List of specimens examined of *SCIURUS CAROLINENSIS* var. *CAROLINENSIS*—Continued.

Catalogue number of skull.	Corresponding number of skull.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.	Remarks.
835	.....	♂	Prairie Mer Rouge, La.	.....	La. Jaa. Fairie	La. Jaa. Fairie	Skin .....	In Nat. Museum.
854	.....	.....	do	.....	do	do	do	do
388	.....	.....	do	.....	do	do	do	do
325	.....	.....	do	.....	do	do	do	do
831	1906	.....	do	.....	do	do	Skin and skull	do
835	1907	.....	do	.....	do	do	do	do
.....	1945	.....	do	.....	do	do	Skull	do
.....	1946	.....	do	.....	do	do	do	do
.....	1947	.....	do	.....	do	do	do	do
8338	.....	♂	Brookhaven, Miss.	.....	T. J. R. Keenan	T. J. R. Keenan	do	do
8339	.....	.....	do	.....	do	do	do	do
8340	.....	.....	do	.....	do	do	do	do
7504	.....	.....	Washington Co., Tex.	.....	Dr. G. Lincoxon	Dr. G. Lincoxon	do	do
8140	.....	♀	Jacksonville, Fla.	Jan. 25, 1899	Allen & Marcy	Allen & Marcy	Skin .....	In Mus. Comp. Zool.
8141	.....	.....	do	Jan. 25, 1899	do	do	do	do
8144	.....	♀	Hibernia, Fla.	Jan. 30, 1899	do	do	do	do
8145	.....	.....	do	Jan. 30, 1899	do	do	do	do
8146	.....	.....	do	Jan. 30, 1899	do	do	do	do
8153	.....	♂	Welaka, Fla.	Feb. 6, 1899	do	do	do	do
8154	.....	.....	do	Feb. 6, 1899	do	do	do	do
8155	.....	.....	do	Feb. 6, 1899	do	do	do	do
8156	.....	.....	do	Feb. 6, 1899	do	do	do	do
8157	.....	.....	do	Feb. 6, 1899	do	do	do	do
8158	.....	.....	do	Feb. 6, 1899	do	do	do	do
8159	.....	.....	do	Feb. 6, 1899	do	do	do	do
8160	.....	.....	do	Feb. 6, 1899	do	do	do	do
8161	.....	.....	do	Feb. 6, 1899	do	do	do	do
8166	.....	.....	do	Feb. 6, 1899	do	do	do	do
8167	.....	.....	do	Feb. 6, 1899	do	do	do	do
8453	.....	♀	Jacksonville, Fla.	Jan. —, 1899	do	do	Alcohol	do
8454	.....	.....	do	Jan. —, 1899	do	do	do	do
8455	.....	.....	do	Jan. —, 1899	do	do	do	do
338	.....	.....	New Leon, Mexico.	Apr. —, 1853	La. D. M. Couch	La. D. M. Couch	Skin and skull	In Nat. Museum.
337	1854	.....	do	Apr. —, 1853	do	do	Skin .....	do

TABLE XXV.—List of specimens examined of *SCIURUS CAROLINENSIS* var. *YUCATANENSIS*.

Catalogue number.	Original number.	Sex.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
8508	848	♂	Merida, Yucatan	Mar., 1895	José Salazar Liarregui	Dr. A. Schott	Skin
8503	849	♀	do	Mar. 2, 1895	do	do	do
8504	334	.....	do	—, 1895	do	do	do
8505	506	.....	do	—, 1895	do	do	do

## SCIURUS NIGER Linn.

## Fox Squirrel.

## Var. NIGER.

## Southern Fox Squirrel.

*Sciurus niger* CATSBY, Carolina, II, 1743, 73, pl. lxxiii.—LINNÆUS, Syst. Nat. I, 1766, 64; I, 1766, 80 (based on Catsey's "Black Squirrel" of Catsey's Carolina).—ERCKLEBEN, Syst. Reg. Anim. 1777, 417.—SCHREBER, Säuget. IV, 1793, 776, pl. cxcv, cxcv".—SHAW, Gen. Zool. II, 1801, 139.—"ORD, Guthrie's Geog. (3d Am. ed.) II, 1815, 292."—DESMAREST, Mam. II, 1822, 334.—LESSON, Man. de Mam. 1827, 235.—ALLEN, Bull. Mus. Comp. Zool. II, 1871, 176.—MAYNARD, Bull. Essex Inst. IV, 1872, 145.

*Sciurus cinereus* var. *niger* ALLEN, Proc. Bost. Soc. Nat. Hist. XVI, 1874, 287.

*Sciurus variegatus* ERCKLEBEN, Syst. Reg. Anim. 1777, 491 (mixed with Mexican species).—GMELIN, Syst. Nat. I, 1788, 151 (in part).—SCHREBER, Säuget. IV, 1793, 789, pl. cxviii (in part; the plate is Buffon's Coquallin).—DESMAREST, Mam. 1822, 333.—FISCHER, Synop. Mam. 1829, 359 (in part).—SCHINZ, Synop. Mam. II, 1845, 17 (in part); and also of other compilers.

*Sciurus tulpius* GMELIN, Syst. Nat. I, 1788, 147.—GODMAN, Am. Nat. Hist. II, 1896, 198.—M'MURTRIE, M'Murtrie's Cuvier (Am. ed.) I, 1831, 433.—BAIRD, Mam. N. Am. 1857, 246.

*Macrotus vulpinus* GRAY, Ann. and Mag. Nat. Hist. 3d ser. XX, 1867, 490.

*Sciurus capistratus* BOEC, Ann. du Muséum, I, 1802, 281.—DESMAREST, Mam. II, 1822, 332.—HARLAN, Faun. Amer. 1825, 175.—LESSON, Man. de Mam. 1827, 239.—H. SMITH, Griffith's Cuvier's An. King. III, 1827, 178 (with plate); V, 1827, 253.—FISCHER, Synop. Mam. 1829, 351.—BACHMAN, Proc. Zool. Soc. Lond. 1835, 85; Charlesworth's Mag. Nat. Hist. III, 1839, 117; Am. Journ. Sci. and Arts, xxxvii, 1839, 291.—WAGNER, Suppl. Schreber's Säuget. III, 1843, 156, pl. cxxiii B (gray variety—no description).—SCHINZ, Synop. Mam. II, 1845, 5.—AUDUBON & BACHMAN, Quad. N. Am. II, 1851, 133, pl. lxxviii.

*Sciurus rufiventris* M'MURTRIE's Cuvier's An. King. (Am. ed.) I, 1831, 433.—SCHINZ, Synop. Mam. II, 1845, 6.  
*Sciurus lutescens* BACHMAN, Proc. Zool. Soc. Lond. 1836, 86; Charlesworth's Mag. Nat. Hist. III, 1839, 154; Silliman's Am. Journ. Sci. and Arts, xxxvii, 1839, 296.

*Le Capistrato*, F. CUVIER, Hist. Nat. des Mam. livr. xxvii, 1819 (plate and text).

*Capistrato gris*, F. CUVIER, Hist. des Mamm. livr. xlviii, 1825 (plate and text).

*Black Squirrel*, CATSBY, PENNANT, and others.

*Le Coquallin*, BUFFON, Hist. Nat. xlii, 1765, 109, pl. xlii (description and figure).

## Var. CINEREUS.

## Northern Fox Squirrel.

*Sciurus cinereus* LINNÆUS, Syst. Nat. I, 1766, 64; I, 1766, 86.—ERCKLEBEN, Syst. Reg. Anim. 1777, 418.—GMELIN, Syst. Nat. I, 1788, 147.—SCHREBER, Säuget. IV, 1793, 766, cxxiii (name on plate).—SHAW, Gen. Zool. II, 1801, 137.—GODMAN, Am. Nat. Hist. II, 1896, 189.—H. SMITH, Griffith's Cuvier's An. King. III, 1827, 177; V, 1827, 253.—M'MURTRIE, M'Murtrie's Cuvier (Am. ed.) I, 1831, 433.—BACHMAN, Proc. Zool. Soc. Lond. VI, 1836, 89; Charlesworth's Mag. Nat. Hist. III, 1839, 159; Silliman's Amer. Journ. Sci. and Arts, xxxvii, 1839, 297.—WAGNER, Suppl. Schreber's Säuget. III, 1843, 159.—SCHINZ, Synop. Mam. II, 1845, 7.—AUDUBON & BACHMAN, Quad. N. Am. I, 1849, 145, pl. xvii.—BAIRD, Mam. N. Am. 1857, 248, pl. xlviii, fig. 2 (skull).—ALLEN, Bull. Mus. Comp. Zool. I, 1869, 292.

*Sciurus cinereus* var. *cinereus* ALLEN, Proc. Bost. Soc. Nat. Hist. XVI, 1874, 287.

*Sciurus vulpinus* SCHREBER, Säuget. IV, 1793, 773, pl. cxcv, B.

*Sciurus virginianus*, KERN's Linnæus's Syst. Nat. 259, 1793.

? "*Sciurus hystrix* ORD, Guthrie's Geog. (3d Am. ed.) II, 1815, 292, 304."

? *Macrotus neglectus* GRAY, Ann. and Mag. Nat. Hist. 3d ser. XX, 1867, 490.

*Capistrato à longue queue*, F. CUVIER, Hist. des Mam. livr. IV, 1826.

*Fox Squirrel*, *Cat Squirrel*, VULGO, and of authors.



## Var. LUDOVICIANUS.

## Western Fox Squirrel.

- Sciurus ludovicianus* CUSTIS, Barton's Med. and Phys. Journ. ii, 1806, 43 (from Red River of "Louisiana").—  
 HARLAN, Faun. Amer. 1825, 186.—H. SMITH, Griffith's Cuvier's An. King. v, 1827, 254.—LESSON, Man. de Mam. 1827, 234.—FISCHER, Synop. Mam. 1829, 351.—BAIRD, Mam. N. Am. 1857, 251.—TOMES, Proc. Zool. Soc. Lond. 1861, 281 (Costa Rica).—HAYDEN, Trans. Am. Phil. Soc. Phila. xii, 1863, 144.—ALLEN, Proc. Bost. Soc. Nat. Hist. xiii, 1869, 188.
- Sciurus ludovicianus* var. *atrocaeruleus* ENGELMANN, Trans. Acad. Sci. St. Louis, i, 1859, 329 (melanistic).
- Sciurus cinereus* var. *ludovicianus* ALLEN, Proc. Bost. Soc. Nat. Hist. xvi, 1874, 287.
- Macronus ludovicianus* GRAY, Ann. and Mag. Nat. Hist. 3d ser. xx, 1867, 420.
- Sciurus rufescens* "GROFFROY, Mus. Par.," Nov. Diet. d'Hist. Nat. x, 103.—DERMAREST, Mam. ii, 1892, 332.—HARLAN, Faun. Amer. 1825, 176 (New Orleans).—LESSON, Man. de Mam. 1827, 233.—FISCHER, Synop. Mam. 1829, 351.—SCHINZ, Synop. Mam. ii, 1845, 6 (specimen from Missouri).—MAXIMILIAN, Wieg. Arch. Z. Naturg. 1861, 70.
- Sciurus macrourus* SAY, Long's Exped. R. Mta. i, 1823, 115 (Kansas).
- Sciurus macrourus* DOUGHTY, Cab. Nat. Hist. i, 1830, 265, pl. xxiii.—"F. CUVIER, Suppl. Buffon's Hist. Nat. i, Mam. 1831, 297."
- Sciurus macrourus* GODMAN, Am. Nat. Hist. ii, 1893, 134.—WOODHOUSE, Sitgreaves's Col. and Zool. Rivers, 1853, 53.
- Sciurus magnicaudatus* HARLAN, Faun. Amer. 1825, 178.—H. SMITH, Griffith's Cuvier's An. King. 1827, 255.—LESSON, Man. de Mam. 1827, 235.—FISCHER, Synop. Mam. 1829, 351.—BACHMAN, Proc. Zool. Soc. Lond. 1838, 88; Charlesworth's Mag. Nat. Hist. iii, 1839, 156; Silliman's Am. Journ. Sci. and Arts, xxvii, 1839, 296.—WAGNER, Suppl. Schreber's Säuget. iii, 1843, 166.—SCHINZ, Synop. Mam. ii, 1845, 11.—KENNICOTT, U. S. Pat. Off. Rep. Agr. 1866 (1867), 56, pl. vi.
- Sciurus subcaerules* BACHMAN, Proc. Zool. Soc. Lond. 1838, 87; Charlesworth's Mag. Nat. Hist. iii, 1839, 155; Silliman's Am. Journ. Sci. and Arts, xxvii, 1839, 296.—WAGNER, Suppl. Schreber's Säuget. iii, 1843, 164.—AUDUBON & BACHMAN, Quad. N. Am. ii, 1851, 67, livii.
- Sciurus auduboni* BACHMAN, Proc. Zool. Soc. Lond. vi, 1838, 97 (Louisiana; dusky variety); Charlesworth's Mag. Nat. Hist. iii, 1839, 378.—WAGNER, Suppl. Schreber's Säuget. iii, 1843, 182.—SCHINZ, Synop. Mam. ii, 1845, 12.—AUDUBON & BACHMAN, Quad. N. Am. iii, 1854, 260, pl. ciii, fig. 2.
- Sciurus occidentalis* AUDUBON & BACHMAN, Journ. Acad. Nat. Sci. Phila. viii, 1849, 317.
- Sciurus rubicaudatus* AUDUBON & BACHMAN, Quad. N. Am. ii, 1851, 30, pl. iv.
- Sciurus sayi* AUDUBON & BACHMAN, Quad. N. Am. ii, 1851, 274, pl. lxxxix.
- Sciurus limbus* BAIRD, Proc. Acad. Nat. Sci. Phila. vii, 1855, 331; Mam. N. Am. 1857, 256 (Texas; immature).

## Var. CINEREUS.

## Northern Fox Squirrel.

VARIETAL CHAR.—Length of body 12 to 13 inches, varying from 11 to 14 or more; tail-vertebræ about 10, varying from 9 to 11; tail to end of hairs 12, varying from 11 to 14. Color variable, but with the nose and ears generally concolor with the dorsal surface. Commonly whitish-gray above, yellowish-white below, with the edges and under surface of the tail fulvous, varying to rufous. Often with a fulvous or rufous cast above, and strongly fulvous or rufous below. Varies to dusky above, with the ventral surface, legs, and feet blackish or black. Maryland and Virginia specimens are rather larger, grading into var. *niger*, with generally the tail more ferruginous.

Of this variety, called by them the Cat Squirrel, Audubon and Bachman

say:—"Perhaps none of our Squirrels are subject to greater varieties of color than the present; we have seen specimens in (formerly) Peale's Museum, of every tint, from light-gray almost to black. Two others that came under our observation were nearly white . . . . We have represented in the plate three of these Squirrels, all of different colors, but the varieties of tint to be observed in different specimens of the Cat Squirrel are so great that among fifty or more perhaps, we never could find two exactly alike; for which reason we selected for our drawing an orange-colored one, a gray one, and one nearly black."\*

In general, var. *cinereus* is smaller than var. *niger*, and may be distinguished from it by the absence of a distinctly white nose and white ears. This, however, is an arbitrary character, since specimens, particularly from Maryland and Virginia, have the nose and ears only grayish rather than whitish, with sometimes the ears not lighter than the surrounding surface. Florida specimens of var. *niger*, on the other hand, have the nose merely grayish, and the ears not lighter than the back, while the grayish nose-patch is small, and sometimes almost wholly restricted to the sides of the nose.

HABITAT.—Atlantic States from Virginia northward to Southern New York and Southern New England; ranges farther southward in the Alleghenies, perhaps to Georgia.

Var. NIGER.

*Southern Fox Squirrel.*

VARIETAL CHAR.—Larger; length of body generally about 13.50, ranging from 12 to 15. Tail-vertebræ about 11, ranging from 10.25 to 12.50; tail to end of hairs 14, ranging from 14 to 16. Color variable, but with the nose and ears whitish, usually in strong contrast with the rest of the dorsal surface. Color generally gray above (rather darker than in var. *cinereus*), whitish beneath, with the tail whitish beneath and on the edges. Varies to more or less fulvous and rufous phases, but more frequently to dusky and black. Often with only the feet, legs, and lower surface black. In the dusky varieties, the head (except the nose and ears) is often intense black. Sometimes with the under parts rufous, and often with the whole pelage mixed dusky and rufous, or with the limbs and head black, and a narrow black dorsal and ventral band. Equally variable in color with the preceding, from which it is to be commonly

\* *Quadrupeds of North America*, vol. 1, pp. 146, 147.

distinguished by its white or whitish nose and ears. Of the dozen or more specimens before me, each differs widely from any of the others.

HABITAT.—South Atlantic and Gulf States, from Maryland to Louisiana.

Var. LUDOVICIANUS.

*Western Fox Squirrel.*

VARIETAL CHAR.—Smaller than the preceding, about equaling in size var. *cinereus*; length of body 12 to 13, ranging from 11 to 14 or more; tail-vertebræ 9.75, ranging from 8.50 to 10.50; tail to end of hairs 12.50, ranging from 11 to 13.50. Color less variable than in vars. *cinereus* and *niger*. Above, dusky-gray, with a strong rufous suffusion; ears, feet, and ventral surface fulvous, varying to bright ferrugineous. The whole under parts are occasionally black or mixed black and rufous, the hairs being annulated with these colors. Never apparently wholly black, nor with the under surface pure white.

This variety is much more constant in its coloration than either of the two preceding, the principal variations being to dusky, annulated with rusty beneath, or with the whole ventral surface black. The ears are generally rufous, in strong contrast with the color of the dorsal surface; the feet and whole lower parts are generally rufous, varying somewhat in intensity in different individuals from the same locality. The upper parts vary from a dusky ferrugineous-gray to a lighter gray, scarcely distinguishable from that of the reddish-gray type of var. *cinereus* from Pennsylvania. There is, however, a considerable amount of geographical variation in color, mainly through a great increase in the intensity of the rufous coloring of the ventral surface southward.

The palest specimens are from the eastern edge of the Plains,—Fort Randall, Dak. Ter.; Kiowa Agency, Ind. Ter.; Guadeloupe and Fort Chadbourne, Tex.,—some of which are nearly white below and much lighter above than examples from other localities. The most rufous come from the Mississippi Valley, particularly from the southern portion. The specimens from Ohio are rather lighter than those from Illinois, while the series from Fort Des Moines, Iowa, inclines strongly toward the more southern type of coloration.

No. 7768, from the Republican Fork, is white below, with merely a faint tinge of fulvous, which becomes somewhat stronger on the chin and throat. The upper parts are about as in specimens from the upper part of the Mississippi Valley. No. 11348, from Fort Randall, is also nearly white over the

ventral surface, passing into fulvous anteriorly, and is also much lighter above than specimens from Northern Illinois. No. 7773, from Sioux City, Iowa, is also pale whitish-fulvous below and light above. Specimens from Northern Illinois are also very pale fulvous beneath, lighter gray above. Fort Des Moines specimens are considerably brighter below than are those from North-eastern Illinois and adjoining portions of Michigan, more approaching the southern type of coloration. In a large series of specimens from Saint Louis, Mo., the ventral surface is strongly rufous, and the dorsal surface is of a darker gray. In others, from Prairie Mer Rouge, La., the under parts are deep orange, with a perceptible further darkening of the color above. We have hence a gradual transition in the color of the under parts from pale yellowish-white, through pale fulvous, deep fulvous, and ferrugineous, to bright reddish-orange, in passing from the Plains and the more northern localities to the swampy region of the Lower Red River in Louisiana. While the upper parts show a less striking change in depth of color, there is a correspondent darkening of the dorsal surface through the larger amount of black and the brighter tint of rufous.

**HABITAT.**—The whole region drained by the Mississippi River and its tributaries, and that bordering the Missouri as far northward as Southern Dakota, extending westward along the wooded streams into the Plains. In other words, from the Alleghanies on the east (where it meets the range of *vars. cinereus* and *niger*) to the eastern portion of the Plains on the west, and from the Great Lakes, Minnesota, and Dakota on the north, to the Gulf coast and the highlands of Mexico on the south. Its habitat is hence far more extended than that of either *cinereus* or *niger*, and includes a far greater range of climatic conditions.

**GENERAL REMARKS ON SCIURUS NIGER AND ITS VARIETIES.**

**DIFFERENTIAL CHARACTERS.**—As already stated, *var. cinereus* differs from *var. niger* mainly in being rather smaller, and in having, as a rule, the nose and ears not white, or not strongly contrasting in color with the rest of the dorsal surface. Audubon and Bachman, and also Professor Baird, refer to the longer and more pointed ears of *var. niger*, but, judging from the specimens before me, this is not a very appreciable character. That such should be the case would be only in accordance with the law of the enlargement of peripheral parts southward, so often exemplified in other Mammals. The more

trustworthy character of white nose and ears in var. *niger*, though open to many exceptions, is the one mainly to be relied upon in distinguishing the two varieties. There is apparently a gradual and quite marked increase in size southward in these two forms, so that size alone fails to be distinctive, especially in the central portion of the Atlantic States, or wherever their habitats meet.

Var. *ludovicianus* is generally readily separable by its coloration from either var. *cinereus* or var. *niger*. The rusty-bellied style of var. *cinereus*, however, is often quite inseparable from specimens of var. *ludovicianus* from northern localities. Particularly is this the case when Pennsylvania specimens of the rufous type are compared with Ohio examples of var. *ludovicianus*. There are, for instance, two specimens before me without labels, and hence from unknown localities, which I cannot positively refer to one of these varieties rather than to the other. There is little, if any, difference in size between vars. *cinereus* and *ludovicianus*, although the latter is pretty constantly appreciably smaller than var. *niger*, as shown by a comparison of the foregoing diagnoses of the three varieties. The external measurements are, unfortunately, nearly all from skins, and are hence not very trustworthy. Taking the skulls as a standard of comparison, var. *niger* averages appreciably the larger, four skulls of *niger* averaging 2.75 against 2.58 in both vars. *ludovicianus* (eight skulls) and *cinereus* (three skulls).

GEOGRAPHICAL VARIATION.—In varieties *cinereus* and *niger*, the only appreciable feature of geographical variation is the before-noted gradual increase in size southward. A large series of specimens, from numerous localities, might show that other variations correlate with differences of locality. My material illustrative of these two forms is unsatisfactorily scanty. Var. *ludovicianus*, on the other hand (thanks to more abundant material), shows strongly marked geographical variations in color, but I fail to notice any well-marked geographical variation in size. Judging from the skulls, the northern specimens are rather the larger, yet the largest skull of the series is from Brookhaven, Miss. The measurements taken from the skins show also a rather greater size northward, the largest specimens being from Ohio and Fort Randall, Dakota, if length of body be taken as the standard; if, on the other hand, the length of the hind foot be adopted, in consequence of being less susceptible to variation resulting from taxidermy, the southern specimens average nearly or quite as large as the

northern. Judged by this standard, the specimens from Saint Louis, Mo., must be regarded as fully as large as those from farther north, if not, indeed, a little larger.

The geographical variation in color in var. *ludovicianus* consists, as already noticed, in an increasing pallor northward and toward the dryer portions of the plains, and, in the country immediately bordering the Mississippi, in a strongly marked increase in color southward.

GEOGRAPHICAL DISTRIBUTION.—Vars. *cinereus* and *niger* occupy the Atlantic slope from New York southward, var. *niger* being found westward in the Gulf States as far as Eastern Louisiana. Var. *cinereus* has been reported as common on Long Island, and as occurring as far eastward as Massachusetts, but, if ever found in the last-named locality, can occur there only very rarely. Both var. *cinereus* and var. *niger* occur in Maryland and Virginia, where their habitats overlap, and the two forms interblend. Probably var. *cinereus* ranges farther southward along the mountains of the interior than along the coast. Var. *ludovicianus* appears to occupy nearly the whole region drained by the Mississippi and its eastern tributaries, and extends up the Missouri to above Fort Randall, and occurs along the Arkansas, the Red, and the other principal rivers that come down from the Plains as far as they are regularly bordered with timber. The westernmost localities represented by the specimens before me are the Republican Fork and the vicinity of Fort Cobb, Indian Territory. It is found throughout a large part of Texas, and doubtless ranges far into Mexico. It has even been reported as occurring as far south as Guatemala,\* but I think the identification in all probability erroneous.

SYNONYMY AND NOMENCLATURE.—The earliest available name for the specific designation of the Fox Squirrels is doubtless *niger*, used by Catesby in 1743, and adopted by Linnæus in the tenth edition of the *Systema Naturæ* (1758), based on the Large Black Squirrel of Catesby, which unquestionably refers to the dark phase of the Southern Fox Squirrel. Immediately following it, on the same page of this edition, is the name *cinereus*, generally considered as referring to the Northern Fox Squirrel, the Cat Squirrel of Bachman. The only objection to *niger* as applicable to the whole group is that it refers to only a single phase of coloration, and not to the most prevalent one, though a very common one. In view of the great frequency of the black and dusky phases of coloration, the objection is one of no great importance, and I hence

\* Toms, Proc. Zool. Soc. Lond. 1861, p. 281.

adopt *niger* as the specific name of the group. The next most prominent name of the Southern Fox Squirrel, and next in date, is *vulpinus* of Gmelin, which Professor Baird adopted for this form in place of the later one, *capistratus*, of Bosc. The latter, however, has been often employed for its designation by both American and foreign authors, and is the name adopted by Bachman.

The Northern Fox Squirrel has commonly borne the name *cinereus*, which is unquestionably the name to be adopted for its varietal designation, although it has been also applied by various authors to *S. carolinensis*. Aside from *vulpinus* of Schreber (*nec* Gmelin), it has no very prominent synonyms.

The Western Fox Squirrel was first described by Custis, in 1806, under the name *ludovicianus*. In consequence of the great variability in color this form presents, it was subsequently redescribed under eight or ten different specific designations, several of which have been at times more or less current for particular phases of coloration, generally supposed to represent forms specifically distinct from *ludovicianus* of Custis. The more prominent among them are *rufiventer* of Geoffroy, used by Desmarest and Harlan, the latter referring to it a specimen from New Orleans; *macroura* of Say, applied to examples from Eastern Kansas, which name, being preoccupied, was changed by Harlan to *magnicaudatus*, and adopted by Bachman and others in place of *ludovicianus*. Bachman applied the name *subauratus* to specimens received from Louisiana, and *auduboni* to black-bellied specimens from the same State. Audubon and Bachman gave the name *sayi* to specimens from the Missouri River, *rubicaudus* to Illinois and Kentucky specimens, and *occidentalis* to dusky specimens supposed to have come from the Pacific coast, but which these authors later referred to their *S. auduboni*. Baird gave the name *limitis* to the pale form of the Plains from Western Texas, based partly at least on small size resulting from immaturity, as shown by his types. More recently, Dr. Engelmann has described melanistic specimens from Saint Louis under the varietal name *atroventris*.

The *S. variegatus* of Erxleben has generally been applied to some of the Mexican species, it being based partly on the *Quahhtecallotlquapachtli* aut *Cotztiocotequallin*\* of Fernandez, and partly upon the *Coquallin* of Buffon.† The latter, as first pointed out by M. F. Cuvier, is certainly the Southern Fox Squirrel (*S. niger* var. *niger*), as shown by its white nose and white

\* Nov. Hesp. p. 8.

† Hist. Nat. vol. xiii, p. 100, pl. xiii.



ears, as represented in Buffon's plate, and hence *S. variegatus* is clearly referable in part (and I think mainly) to the Southern Fox Squirrel of the present article. The animal described very imperfectly under the above-cited names by Fernandez is apparently referable to the *S. hypopyrrhus* of Wagler, § as claimed by the last-mentioned author.

TABLE XXVI.—Measurements of ten specimens of *SCIURUS NIGER* var. *CINEREUS*.

Catalogue-number of skin.	Original number.	Locality.	Sex.	From tip of nose to—		Tail to end of—		Length of—		Nature of specimen.
				Occiput.	Tail.	Vertebra.	Hairs.	Fore foot.	Hind foot.	
23	.....	Carlisle, Pa. ....	.....	2.70	11.50	.....	12.00	.....	2.90	Measurements from Baird's Mamm. N. Amer. p. 350.
343	.....	.....do.....	.....	2.70	11.00	2.00	11.00	.....	2.90	.....do.....
394	.....	Prince George's Co., Md. ....	.....	.....	.....	2.00	13.20	.....	2.85	.....do.....
395	.....	.....do.....	.....	.....	12.20	2.00	11.00	.....	2.75	.....do.....
396	.....	.....do.....	.....	.....	.....	10.00	11.40	.....	2.70	.....do.....
330	332	Washington, D. C. ....	♂	2.80	15.25	11.00	15.00	.....	2.90	.....do.....
330	.....	.....do.....	.....	.....	.....	10.00	13.50	.....	2.05	.....do.....
333	.....	Clarke County, Va. ....	.....	.....	.....	10.80	14.75	.....	2.80	.....do.....
333	.....	Pennsylvania!.....	♂	.....	19.12	7.50	11.50	.....	.....	Measurements from Aud. and Bach. Qd. N. Am. i. p. 115.
.....	.....	Pennsylvania.....	♀	3.00	12.00	11.00	14.00	2.00	3.00	.....do.....

TABLE XXVII.—Measurements of eight specimens of *SCIURUS NIGER* var. *NIGER*.

Catalogue-number.	Locality.	Sex.	From tip of nose to—				Tail to end of—		Length of—		Nature of specimen.
			Eyes.	Ears.	Occiput.	Tail.	Vertebra.	Hairs.	Fore foot.	Hind foot.	
1380	Tarboro', N. C. ....	.....	.....	.....	2.00	15.00	10.75	14.50	.....	3.00	Measurements from Baird's Mamm. N. Amer. p. 348.
344	South Carolina.....	.....	.....	.....	2.60	13.00	11.25	15.25	.....	3.00	.....do.....
95	Southern States.....	.....	.....	.....	2.70	14.50	12.00	16.00	.....	3.80	.....do.....
1633	Florida.....	.....	.....	.....	.....	13.50	11.50	15.00	.....	.....	.....do.....
1634	.....do.....	.....	.....	.....	.....	.....	10.25	14.00	.....	3.00	.....do.....
.....	Southern States.....	.....	.....	.....	.....	14.50	12.25	15.16	1.75	2.94	Measurements from Aud. and Bach. Qd. N. Am. ii. p. 139.
*9050	Hibernia, Fla. ....	♂	.....	.....	.....	12.75	10.50	19.50	.....	.....	Measured fresh.
*9099	Hawkinsville, Fla. ....	♀	1.00	2.75	2.17	13.00	12.00	16.50	2.65	3.03	.....do.....

\* In Museum of Comparative Zoology, Cambridge, Mass.

§ See Laiz, 1831, p. 510.



TABLE XXVIII.—Measurements of twenty-nine specimens of *SCIURUS NIGER* var. *LUDOVICIANUS*.

Catalogue-number.	Locality.	Sex.	From tip of nose to—		Tail to end of—		Length of hind foot.	Nature of specimen.	Remarks.
			Occiput.	Tail.	Vertebrae.	Hairs.			
174	Port Clinton, Ohio .....	.....	.....	.....	9.50	12.00	2.75	Skin	Measurements from Baird's Mamm. N. Amer. p. 256.
175	.....do .....	.....	.....	14.50	8.00	10.50	.....	do	.....do
2351	Ann Arbor, Mich .....	.....	.....	12.50	.....	.....	2.00	do	.....do
170	Milwaukee, Wis .....	.....	.....	13.00	10.00	13.50	2.90	do	.....do
179	Racine, Wis .....	.....	.....	13.50	9.90	12.00	2.85	do	.....do
1151	.....do .....	.....	2.00	11.00	12.00	.....	2.85	do	.....do
2371	West Northfield, Ill .....	♂	2.75	11.00	10.00	11.00	2.80	do	.....do
719	.....do .....	.....	2.00	11.00	9.45	12.00	2.80	do	.....do
718	.....do .....	.....	2.50	12.00	8.50	11.00	2.90	do	.....do
1983	.....do .....	.....	2.40	9.50	.....	.....	2.70	do	.....do
781	Prémont, Ill .....	♂	.....	.....	10.45	13.00	2.80	do	.....do
2373	Jackson, Ill .....	♂	2.75	12.00	.....	14.75	2.85	do	.....do
1105	Fort Des Moines, Iowa .....	♀	.....	.....	9.00	12.00	2.40	do	.....do
1194	.....do .....	♂	2.40	12.00	8.30	11.00	2.70	do	.....do
2353	.....do .....	.....	2.00	11.50	7.00	.....	2.00	do	.....do
616	Saint Louis, Mo .....	♂	2.00	11.50	10.00	13.50	2.80	do	.....do
617	.....do .....	♂	.....	.....	10.50	13.25	2.80	do	.....do
1301	.....do .....	.....	.....	12.00	10.00	12.90	2.80	do	.....do
1302	.....do .....	♀	.....	12.50	8.50	13.00	2.80	do	.....do
1346	.....do .....	.....	2.00	13.00	10.00	13.00	2.90	do	.....do
1405	Lexington, Mo .....	.....	2.50	11.25	10.00	13.00	2.80	do	.....do
1681	Fort Randall, Dak .....	.....	.....	14.00	7.75	12.00	2.30	do	.....do
953	Prairie Mer Rouge, La .....	.....	.....	11.90	7.00	8.80	2.60	do	.....do
399	.....do .....	.....	.....	11.00	8.35	12.00	2.40	do	.....do
2096	.....do .....	.....	.....	12.50	9.35	12.50	2.75	do	.....do
2297	.....do .....	.....	.....	12.00	8.65	12.00	2.75	do	.....do
2298	.....do .....	.....	.....	12.00	7.80	11.50	2.50	do	.....do
2509	.....do .....	.....	.....	10.90	8.90	12.00	2.55	do	.....do
2534	Guadalupe Bottom (near Indianola), Tex.	.....	.....	11.00	8.00	11.50	.....	do	.....do

TABLE XXIX.—Measurements of three skulls of *SCIURUS NIGER* var. *CINEREUS*.

Catalogue-number.	Locality.	Total length.	Greatest width.	Distance between orbits.	Nasal bones, length.	Nasal bones, width behind.	Nasal bones, width below.	Upper incisors from front to hinder margin of palate.	Upper incisors from front to hinder margin of palate.	Upper incisors, height.	Upper incisors, width between external edges.	Upper molars, length taken together.	Upper molars, distance between.	Lower jaw, length.	Lower jaw, height.
833	East'n Shore of Maryland.	2.50	.....	0.87	0.35	0.30	0.40	0.60	1.30	0.33	0.35	0.47	0.33	1.00	0.70
939	Washington, D.C. (marked)	2.70	1.55	0.90	0.38	0.36	0.44	0.67	1.35	0.35	0.34	0.45	0.34	1.00	0.67
736	Carlisle, Pa .....	2.55	1.59	0.86	0.36	0.36	0.44	0.77	1.39	0.42	0.35	0.47	0.39	1.46	0.90

TABLE XXX.—Measurements of four skulls of SCIURUS NIGER var. NIGER.

Catalogue number.	Locality.	Total length.	Greatest width.	Distance between orbits.	Nasal bones, length.	Nasal bones, width behind.	Nasal bones, width before.	Upper incisors from front to molars.	Upper incisors from front to hinder margin of palate.	Upper incisors, height.	Upper incisors, width between external edges.	Upper molars, length taken together.	Upper molars, distance between.	Lower jaw, length.	Lower jaw, height.
3004	Georgia.....	2.77	1.68	1.00	1.73	0.97	0.44	0.85	1.40	0.59	0.97	0.51	0.35	.....	.....
3003	do.....	2.75	1.67	1.00	0.97	0.30	.....	0.90	1.45	0.54	0.96	0.53	0.35	.....	.....
7636	Natobes, Miss.....	2.75	1.55	1.00	0.98	0.83	.....	0.65	1.40	0.50	0.96	0.51	.....	1.54	0.90
*247	South Carolina†.....	2.75	1.60	0.96	1.00	0.85	0.43	0.87	1.45	0.53	0.97	0.50	0.36	1.53	0.90

\* In Museum of Comparative Zoology, Cambridge, Mass.

TABLE XXXI.—Measurements of nine skulls of SCIURUS NIGER var. LUDOVICIANUS.

Catalogue number.	Locality.	Total length.	Greatest width.	Distance between orbits.	Nasal bones, length.	Nasal bones, width behind.	Upper incisors from front to molars.	Upper incisors from front to hinder margin of palate.	Upper incisors, height.	Upper incisors, width between external edges.	Upper molars, length taken together.	Upper molars, distance between.	Lower jaw, length.	Lower jaw, height.
9466	Burlington, Iowa.....	2.63	1.60	0.94	0.90	0.90	0.78	1.33	0.46	0.96	0.46	0.33	1.50	0.87
1785	Saint Louis, Mo.....	2.60	1.58	0.86	0.69	0.91	0.80	1.30	0.45	0.95	0.46	0.38	1.46	0.85
1879	West Northfield, Ill.....	2.60	1.50	0.86	0.90	0.93	0.80	1.30	0.50	0.95	0.50	0.39	1.47	0.85
3131	Prairie Mor Rouge, La.....	2.55	.....	.....	0.87	0.91	0.80	1.25	.....	.....	0.44	.....	1.45	.....
3130	do.....	2.53	1.50	.....	0.85	0.93	0.80	1.30	.....	.....	.....	.....	1.45	.....
1805	do.....	2.53	.....	.....	0.84	0.98	0.78	1.25	.....	.....	.....	.....	1.45	.....
6348	Fort Riley, Kane.....	2.46	1.46	.....	0.86	0.90	0.75	1.07	.....	.....	.....	.....	1.47	.....
*1885	Devil's River, Tex.....	2.35	1.31	.....	0.77	0.91	0.67	1.16	.....	.....	.....	.....	1.37	.....
19326	Brookhaven, Miss.....	2.06	1.55	.....	0.94	0.98	0.67	1.37	.....	.....	.....	.....	1.56	0.90

\* Type of *S. "humbilis"*; not fully adult.† Perhaps var. *niger*.

TABLE XXXII.—List of specimens examined of *SCIURUS NIGER* var. *CIMMERUS*.

Catalogue-number of skin.	Corresponding number of skull.	Locality.	From whom received.	Collected by—	Nature of specimen.
*1500		Pennsylvania.....	J. T. Rothrock .....	J. T. Rothrock .....	Skin.
*1561		do .....	do .....	do .....	do.
*212		Beaufort, N. C.....	A. S. Bickmore .....	A. S. Bickmore .....	Alcoholic.
	756	Carlisle, Pa.....	S. F. Baird .....	S. F. Baird .....	Skull.
	609	do .....	do .....	do .....	do.
	4340	do .....	do .....	do .....	do.
	23	do .....	do .....	do .....	Skin.
	855	Prince George County, Maryland.....	do .....	do .....	Skull.
345		do .....	Mr. Plummer .....	Mr. Plummer .....	Skin.
904		do .....	do .....	do .....	do.
225		do .....	do .....	do .....	do.
	933	District of Columbia.....	S. F. Baird .....	S. F. Baird .....	Skull.
4043		do .....	C. Drexler .....	C. Drexler .....	Skin.
30		Washington, D. C. (market).....	Mr. Plummer .....	Mr. Plummer .....	do.
2586		Clarke County, Virginia.....	Dr. C. R. R. Kennerly.....	Dr. C. R. R. Kennerly.....	do.
*4873		Maryland .....	J. A. Allen .....	P. L. Joay .....	Skin and skull.

\*In Museum of Comparative Zoology, Cambridge, Mass.

TABLE XXXIII.—List of specimens examined of *SCIURUS NIGER* var. *NIGER*.

Catalogue-number of skin.	Corresponding number of skull.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.	Remarks.
1261		Tarboro', N. C.....		J. L. Bridger .....	J. L. Bridger .....	Skin .....	
1262		do .....		do .....	do .....	do .....	
1263		do .....		do .....	do .....	do .....	
1264		do .....		do .....	do .....	do .....	
1265		do .....		do .....	do .....	do .....	
1266		do .....		do .....	do .....	do .....	
95		Southern States .....		Acad. Nat. Sci. Phila.* .....	do .....	do .....	Head nearly black.
344		do .....		do .....	do .....	do .....	Head wholly black except nose and ears.
1483		Columbus, Ga.....		Dr. Gesser .....	Dr. Gesser .....	do .....	
3003		Georgia.....		Dr. Jones .....	Dr. Jones .....	Skull .....	
3004		do .....		do .....	do .....	do .....	
7632		Natchez, Miss .....		F. J. R. Keenan .....	F. J. R. Keenan .....	do .....	
3249		New Orleans, La.....		do .....	do .....	do .....	
*1150		Hibernia, Fla.....	Feb. 1, 1889	Florida Exped .....	Allen & Marcy .....	Alcoholic .....	
*1160		Hawkinsville, Fla.....	Mar. 19, 1889	do .....	do .....	Skin .....	

\*In Museum of Comparative Zoology, Cambridge, Mass.

TABLE XXXIV.—List of specimens examined of *SCIURUS NIGER* var. *LUDOVICIANUS*.

Catalogue-number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.	Remarks.
*3018				Evanston, Ill.		O. Marcy	O. Marcy	Alcoholic	
*1635				Marion, Ogle Co., Ill.	June 26, 1867	J. A. Allen	J. A. Allen	Skin	
*1636				do	Sept. 30, 1867	do	do	do	
*1637				do	Sept. 30, 1867	do	do	do	
*1638				do	Sept. 30, 1867	do	do	do	
*1639				do	Sept. 30, 1867	do	do	do	
*1640				do	Sept. 30, 1867	do	do	do	
*1641				do	Sept. 30, 1867	do	do	do	
*1644				do	Sept. 30, 1867	do	do	do	
*9082				Jasper Co., Iowa	May 28, 1867	H. W. Parker	H. W. Parker	do	
*1607				Bofield, Iowa	Aug. 22, 1867	J. A. Allen	J. A. Allen	do	
*1608				do	Aug. 22, 1867	do	do	do	
*1640				do	Aug. 22, 1867	do	do	do	
*1643				do	Aug. 22, 1867	do	do	do	
*200				Rollin, Mich.		W. J. Beal	W. J. Beal	Alcoholic	
*198				do		do	do	do	
*199				do		do	do	do	
174				Cleveland, Ohio		Dr. Kirtland	Dr. Kirtland	Skin	
175				Port Clinton, Ohio		do	do	do	
245				West Northfield, Ill.		R. Kennicott	R. Kennicott	do	
784				do	Spring, 1855	do	do	do	
719				do	Winter, 54-55	do	do	do	
719				do	do	do	do	do	
1083				do	do	do	do	do	Belly black.
1879				do	do	do	do	Skull	
7048				Peoria, Ill.		Mr. Bishop	Mr. Bishop	Skin	
8115				Mt. Carroll, Ill.	Oct. 26, 1894	do	do	do	
761				Freeport, Ill.	Jan. —, 1835	W. F. Shaw	W. F. Shaw	do	
171				Racine, Wis.		Dr. P. B. Hoy	Dr. P. B. Hoy	do	Belly black.
179				do		do	do	do	
179				Milwaukee, Wis.	Spring	S. Sercomb	S. Sercomb	do	
9351				Ann Arbor, Mich.		C. Fox	C. Fox	do	
7173		64	♂	Sioux City, Iowa	May 24, 1864	J. Fellner	J. Fellner	do	
6648				do		do	do	Skull	
9353				Iowa		W. E. Moore	W. E. Moore	Skin	
1194				Ft. Des Moines, Iowa	Autumn	do	do	do	
1185				do		do	do	do	
9308				do		do	do	do	Belly black.
9095				do		do	do	do	
2440				Burlington, Iowa		T. Glover	T. Glover	Skull	
1800				Mouth of Vermilion	Oct. 25, —	F. V. Hayden	F. V. Hayden	Skin	
1821				Fort Randall, Dak.		do	do	do	
11348				do	Spring, 1873	Dr. E. Coues	Dr. E. Coues	do	
7041				Cherokee Nation		Dr. E. Palmer	Dr. E. Palmer	do	
4297	4349			Fort Riley, Kas.		Dr. H. Brandt	Dr. H. Brandt	Skin and skull	
4298	4350			do		do	do	do	
4346				do		do	do	Skull	
9089				Kiowa Agency, near Fort Cobb.	Nov. 12, —	Dr. E. Palmer	Dr. E. Palmer	Skin	
9090				do	Nov. 12, —	do	do	do	
9270				do	Nov. 12, —	do	do	do	
9271				do	Nov. 21, —	do	do	do	

\* In Museum of Comparative Zoölogy, Cambridge, Mass.

TABLE XXXIV.—List of specimens examined of *SCIURUS NIGER* var. *LUDOVICANUS*—Continued.

Catalogue-number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.	Remarks.
.....	8092	.....	.....	Kiowa Agency, near Fort Cobb.	.....	Dr. E. Palmer	Dr. E. Palmer	Skull.....	
7776	.....	.....	.....	Republican R., Kana	May 22, 1884	Dr. E. Coues	Dr. E. Coues	Skin.....	
7777	.....	.....	.....	do	May 22, 1884	do	do	do	
7778	.....	.....	.....	do	May 22, 1884	do	do	do	
7704	0000	00	.....	Month of Vernal, Ilon, Missouri R.	May 5, 1884	.....	J. Felner	.....	
3163	.....	.....	.....	Independence, Mo.	June —, 1837	J. G. Cooper	J. G. Cooper	.....	
3166	3383	.....	♂	do	do	do	do	Skin and skull	
3167	.....	.....	♂	do	June 27, 1837	do	do	Skin	
3171	.....	.....	.....	do	June 30, 1837	do	do	do	
.....	3324	.....	.....	Western Missouri	.....	do	do	Skull	
.....	3684	.....	.....	do	.....	do	do	do	
.....	1340	.....	.....	do	.....	do	do	do	
.....	941	.....	.....	do	.....	do	do	do	
331	.....	.....	.....	do	.....	do	do	Skin	
333	.....	.....	.....	Brookhaven, Mo.	.....	F. J. R. Keenan	F. J. R. Keenan	do	
616	.....	.....	♂	Saint Louis, Mo.	Apr. 9, 1853	Dr. Geo. Engelmann.	Dr. Geo. Engelmann.	do	" <i>Sciurus mag-nificus</i> ." "
619	.....	.....	♂	do	Apr. 9, 1853	do	do	do	
1301	.....	.....	♀	do	Dec. —, 1853	do	do	do	
1802	.....	.....	♀	do	Nov. —, 1853	do	do	do	
1803	.....	.....	♂	do	Nov. —, 1853	do	do	do	
1806	.....	.....	♂	do	Nov. —, 1853	do	do	do	
1344	.....	.....	♂	do	Winter, 1853	do	do	do	
1345	.....	.....	.....	do	do	do	do	do	
1346	.....	.....	.....	do	do	do	do	do	
.....	1763	.....	.....	do	do	do	do	Skull	
1496	.....	.....	.....	Missouri	.....	.....	Lt. G. K. Warren	Skin	
718	.....	.....	♀	Fort Leavenworth, Kana.	Nov. 27, 1854	.....	Lt. D. N. Couch	do	
101	.....	.....	.....	Prairie Mer Rouge, La.	June 23, 1858	Lt. Jas. Fairie	Lt. Jas. Fairie	do	
352	.....	.....	.....	do	do	do	do	do	
353	.....	.....	.....	do	June 23, 1858	do	do	do	
9284	.....	.....	.....	do	do	do	do	do	
9296	.....	.....	.....	do	do	do	do	do	
9297	.....	.....	.....	do	do	do	do	do	
9299	.....	.....	.....	do	do	do	do	do	
9298	.....	.....	.....	do	do	do	do	do	
.....	1943	.....	.....	do	do	do	do	Skull	
.....	1904	.....	.....	do	do	do	do	do	
.....	1305	.....	.....	do	do	do	do	do	
.....	1348	.....	.....	do	do	do	do	do	
9300	3132	.....	.....	do	do	do	do	Skin and skull	Dusky.
9301	3131	.....	.....	do	do	do	do	do	
9308	.....	.....	.....	do	do	do	do	Skin	
4753	.....	.....	.....	Grand Coteau, La.	.....	St. Charles Col-lege.	St. Charles Col-lege.	do	
4756	.....	.....	.....	do	do	do	do	do	
4753	.....	.....	.....	do	do	do	do	do	
4754	.....	.....	.....	do	do	do	do	do	
1789	.....	.....	.....	Texas	.....	Capt. J. Pope.	Capt. J. Pope.	do	

\* Belly black.

TABLE XXXIV.—List of specimens examined of *SCIURUS NIGER* var. *LUDOVICIANUS*—Continued.

Catalogue-number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.	Remarks.
2253	.....	.....	.....	Pecos River, Tex.	.....	Capt. J. Pope.	Dr. G. C. Shumard.	Skin	
1630	.....	.....	.....	Ft. Chadbourne, Tex.	.....	.....	Dr. Swift	do	
2354	.....	.....	.....	Guadalupe Bottom, Tex.	Apr. 6, 1856	.....	Capt. J. Pope.	do	
351	.....	.....	.....	San Pedro, Rio Grande, Tex.	.....	Col. J. D. Graham.	J. H. Clark.	do	" <i>Sciurus linita</i> ."
1415	.....	.....	.....	Devil's River, Tex.	.....	do	do	do	do.
2858	.....	.....	.....	do	.....	do	do	Skull	do (type).
1965	.....	.....	.....	do	.....	do	do	do	
7501	.....	.....	.....	Washington Co., Tex.	.....	.....	.....	do	
1934	336	.....	.....	New Leon, Mex.	.....	Lt. D. N. Couch	Lt. D. N. Couch	Skin and skull.	

## SCIURUS FOSSOR Peale.

## California Gray Squirrel.

*Sciurus fossor* PEALE, Mam. and Birds, U. S. Ex. Exp. 1848, 55.—AUDUBON & BACHMAN, Quad. N. Am. III, 1854, 364, pl. ciii, fig. 3.—BAIRD, Mam. N. Am. 1857, 364.—COOPER, Proc. Cal. Acad. Sci. III.—GRAY, Ann. and Mag. Nat. Hist. 3d ser. xx, 1867, 426.—ALLEN, Proc. Bos. Soc. Nat. Hist. xvi, 1874, 287.

*Sciurus heermanni* LE CONTE, Proc. Acad. Nat. Sci. Phila. vi, 1852, 149.

*Sciurus leporinus* HENSHAW, Ann. Rep. Ch. Engineers for 1876, App. JJ, 310 (probably not *S. leporinus* Bachman).

**SPECIFIC CHAR.**—Length of body 11 to 12 inches. Tail-vertebræ about 11, ranging from 10.50 to 12.50; tail to end of hairs 14.50, ranging from 14 to 15.50, hence much longer than the body. Above, clear plumbeous-gray; beneath, pure white; no lateral line; hairs of the tail gray at base, with a broad subterminal band of black, and broadly tipped with white; posterior surface of ears brownish, particularly toward the base.

This species is remarkable for the constancy of its coloration. Among some thirty specimens before me, only two depart much from the normal phase, as above described. One is No. 2463, from near San Francisco, which is faintly washed above with pale reddish-brown. The other is No. 3633, from Fort Tejon, which is evidently in an abnormal condition of pelage. This has the back brownish, and an unsymmetrical, irregularly-shaped spot of brownish-yellow on the top of the head. Professor Baird also refers to a specimen from San Francisco with a brownish back. There is a slight variation in color with locality, specimens from northern localities being of a

darker purer gray than those from the more desert region southward; Fort Tejon specimens, as compared with others from Oregon, presenting a bleached or faded appearance. The skulls show no appreciable difference in size with locality; southern specimens are certainly *not smaller* than northern ones.

This species differs from the Eastern Gray Squirrel (*S. carolinensis*) in its larger size, relatively much longer tail, and in the gray of the upper parts wholly lacking the fulvous suffusion seen in that species, and in being purer white below. *S. fessor* much more resembles the wholly gray phase of *S. aberti*, the two species being of about the same size. *S. aberti*, however, has a shorter and whiter tail, especially beneath, and has usually a dark reddish-brown area on the back and a very distinct black lateral line. It is further distinguished, especially in winter, by the presence of long conspicuous ear-tufts, as well as by the much larger size of the ears themselves.

*S. fessor* is apparently wholly restricted to the Pacific slope, no specimens having been reported as occurring east of the Sierra Nevada and Coast Ranges of mountains. Specimens are in the collection from as far north as Fort Dalles, Oreg., and from intermediate localities thence southward to Fort Tejon, much beyond which, in either direction, its occurrence has not been reported. Its habitat is hence quite restricted. Its nearest ally is to be found in *S. colliciei* of Mexico, with which it agrees in size and in the relative length of the tail, differing from it, however, greatly in coloration.

Melanistic phases of coloration are thus far unknown in this species; but since they occur in all the other North American *Sciuri*, they are to be looked for also in this.

The *Sciurus leporinus* of Bachman, doubtfully referred by Professor Baird to *S. fessor*, agrees much better with *S. colliciei* than with *S. fessor*. It may, however, have been based on an abnormal specimen of *S. fessor*. A specimen in abnormal pelage, collected by Mr. H. W. Henshaw in Southern California in 1875, I at first identified as satisfactorily meeting the requirements of Audubon and Bachman's *S. leporinus*, but a reëxamination of the subject convinces me that their description of *S. leporinus* better agrees with certain phases of *S. colliciei* than with any known phase of *S. fessor*, and that the locality of the specimen was Western Mexico instead of "Northern California", as supposed.

TABLE XXXV.—Measurements of nine specimens of *SCIURUS FOSSOR*.

Catalogue number.	Original number.	Locality.	Sex.	From tip of nose to—				Tail to end of—		Length of—		Nature of specimen.
				Eye.	Ear.	Occiput.	Tail.	Vertebra.	Hairs.	Fore foot.	Hind foot.	
1009		Fort Dallas, Oreg. Ter .....	♀	.....	.....	.....	.....	13.50	15.50	.....	.....	Fresh.
1003		.....do.....	♂	.....	.....	.....	.....	11.25	10.00	14.00	1.50	.....do.
1004		.....do.....	♀	.....	.....	.....	.....	11.50	11.00	14.25	.....	.....do.
2411		Petaluma, Cal. ....	♀	1.35	2.45	2.80	11.25	11.00	14.75	2.00	2.10	.....do.
2641		Fort Crook, Cal. ....	♀	.....	.....	.....	12.00	11.25	14.50	1.65	2.35	Skin.
1174		San Francisco, Cal. ....	♂	1.30	2.35	2.85	12.00	11.00	15.00	.....	2.97	.....do.
12540		Mountains near Kernville, Cal. ....	♂	1.33	2.25	2.65	13.00	10.50	14.00	1.72	2.55	.....do.
18614	281	Tejon Mountains, Cal. ....	♂	.....	.....	.....	11.50	9.50	13.00	1.70	2.70	.....do.
18615	265	.....do.....	♀	1.10	1.90	2.50	11.00	10.25	19.50	1.60	2.70	.....do.

TABLE XXXVI.—Measurements of ten skulls of *SCIURUS FOSSOR*.

Catalogue number.	Locality.	Sex.	Total length.	Greatest width.	Nasal bones, length.	Nasal bones, width behind.	Lower jaw, length.	Lower jaw, height.
2117	Stockton, Cal. ....	.....	2.33	1.50	1.00	0.94	1.57	0.60
4166	Fort Crook, Cal. ....	♀	2.40	1.62	0.90	0.80	.....	.....
4167	.....do.....	.....	2.44	1.57	0.97	0.15	.....	.....
4260	.....do.....	.....	2.36	1.45	0.90	0.26	.....	.....
4745	.....do.....	.....	2.36	1.51	0.93	0.94	1.80	0.95
4753	.....do.....	.....	2.36	1.52	0.97	0.23	.....	.....
5547	Fort Tejon, Cal. ....	.....	2.32	1.50	0.90	0.80	.....	.....
3546	.....do.....	.....	2.32	1.47	0.90	0.23	.....	.....
3595	.....do.....	.....	2.40	1.46	1.00	0.21	.....	.....
15495	Tejon Mountains, Cal. ....	♂	2.40	1.50	0.93	0.15	1.57	0.90



TABLE XXXVII.—List of specimens examined of *SCIURUS FORBESI*.

Catalogue number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
1009	36	♀	♀	Fort Dalles, Oreg.	Jan. 17, 1885	Gov. I. I. Stevens.	Dr. Geo. Sockley.	Skin.
1063	37	♂	♂	do	Jan. 15, 1885	do	do	do.
1004	38	♀	♀	do	Jan. 15, 1885	do	do	do.
9010				do	do	do	do	Skull.
9011				do	do	do	do	do.
1173				Stockton, Cal.		Lt. R. S. Williamson	Dr. J. S. Newberry	Skin.
1174				do		do	do	Skull.
*583				San Francisco, Cal.		do	do	Skin.
*584				do		A. Agassiz	A. Agassiz	Alcohol.
1175				do		do	do	do.
3830				Fort Jones, Cal.		Lt. R. S. Williamson	Dr. J. S. Newberry	Skin.
3841		♀	♀	Fort Crook, Cal.		John Felner	John Felner	do.
3844			♀	do		do	do	do.
3845			♀	do		do	do	do.
5808			♂	do	Mar. 31, 1891	D. F. Parkinson	D. F. Parkinson	do.
5809			♂	do	Mar. 22, 1891	do	do	do.
5805			♀	do	Nov. 9, 1890	do	do	do.
4167	4189			do		John Felner	John Felner	Skin and skull.
4166	4187			do		do	do	do.
3838	4197			do		do	do	do.
3845	4198			do		do	do	do.
	4199			do		do	do	Skull.
	4200			do		do	do	do.
	4201			do		do	do	do.
	6596			do		do	do	do.
	4769			do		do	D. F. Parkinson	do.
	4755			do		do	do	do.
	4756			do		do	do	do.
	4748			do		do	do	do.
	4751			do		do	do	do.
	4752			do		do	do	do.
	4753			do		do	do	do.
	4785			do		do	do	do.
	6598			do		do	do	do.
		972		Michigan Bluffs, Cal.	—, 1893	F. Gruber	F. Gruber	Skin.
347				California.				do.
1590			♂	Fort Tejon, Cal.		John Xantus	John Xantus	do.
1653			♀	do		do	do	do.
3633		338		do		do	do	do.
3293	3*95			San Diego, Cal.		do	do	Skin and skull.
	3547			do		do	do	Skull.
	3548			do		do	do	do.
	3549			do		do	do	do.
	1604			Tejon Valley, Cal.		do	do	do.
9463				Presidio, Cal.				Skin.
9468				San Diego, Cal.		Dr. J. H. Webb	Dr. J. H. Webb	do.

\* In Museum of Comparative Zoology, Cambridge, Mass.

## SCIURUS ABERTI Woodh.

## Abert's Squirrel.

- Sciurus dorsalis* WOODHOUSE, Proc. Acad. Nat. Sci. Phila. vi, 1852, 110 (not *S. dorsalis* of Gray).  
*Sciurus aberti* WOODHOUSE, Proc. Acad. Nat. Sci. Phila. vi, 1852, 220; Sitgreaves's Expl. Colorado and  
 Zuni Rivers, 1853, 53, Mam. pl. vi.—AUDUBON & BACHMAN, Quad. N. Am. iii, 1854, 202, pl.  
 cllii, fig. 1.—BAIRD, Mam. N. Am. 1857, 207.—ALLEN, Proc. Bost. Soc. Nat. Hist. xvi, 1864,  
 287.—COUES, Am. Nat. i, 1867, 355.—COUES & YARROW, Wheeler's Surv. and Expl. West of  
 100th Merid. v, Zool. 1876, 115.  
*Sciurus aberti* GRAY, Ann. and Mag. Nat. Hist. 3d. ser. xx, 1867, 417 (lege *aberti*).  
*Sciurus castaneotus* BAIRD, Proc. Acad. Nat. Sci. Phila. vii, 1855, 332 (typ. error for *castaneotus*).  
*Sciurus castaneotus* BAIRD, Mam. N. Am. 1857, 206; U. S. and Mex. Bound. Surv. ii, pt. ii, 1859, 35, pl. v.

**SPECIFIC CHARs.**—Length of body 11 inches; of tail-vertebræ 8; of tail to end of hairs 12. Above, plumbeous-gray, with generally a more or less broad dorsal area of reddish-brown; beneath, pure white; sides of the body with a distinct, generally conspicuous, black line, separating the white of the under parts from the gray of the upper parts. Runs into melanistic phases, in which the color varies from brownish-fusca to uniform black throughout. Tail centrally black above, broadly edged with white, wholly white below. Ears very large; in winter, with long pointed ear-tufts, an inch to an inch and a half in length. The ears are larger in this species than in any other American species of the genus.

The brownish area on the back varies in color from yellowish-brown to strong reddish-brown or bright chestnut, and in extent from a short narrow stripe along the middle of the back, one to three inches in length, to a broad band extending the whole length of the body, which sometimes widens so as to cover the whole back from the nape to the tail. It is occasionally almost wholly obsolete, and, when confined to a narrow stripe, is much paler than when of larger extent. Some specimens have a chestnut spot at the posterior base of the ear, which sometimes involves the basal half of the ear-tuft; most of the specimens are without the chestnut ear-patch. Nearly half of the specimens are also wholly without ear-tufts. This is apparently a seasonal feature, but may be to some extent individual. Of specimens obtained the same day at the same locality, some have well-developed ear-tufts, while others are wholly without them. The majority of the specimens taken in summer show no trace of ear-tufts.

There are four specimens from Colorado City, Colo., which present a melanistic phase of coloration,\* varying from pale yellowish-brown to black.

\* Dr. Coues informs me that the black Abert's Squirrels are the prevailing style in portions of Colorado. The collection made by Mrs. M. A. Maxwell in the vicinity of Boulder contains several examples of this phase, which, Dr. Coues was assured by this lady, is much more commonly found there than the normal one.

Some of these have well-developed ear-tufts, while others are entirely without them. One specimen has the posterior half of the dorsal surface dusky yellowish-brown, while the rest of the body is dusky, and the tail is nearly black. There is also a wholly black specimen in the collection from the Apache Mountains, Arizona.

This species is considerably smaller than *S. fossor*, with a rather stouter body and shorter tail. One specimen (No. 9549), from the mountains north of Santa Fé, N. Mex., has the general color above of *S. fossor*, showing only a very narrow yellowish-brown dorsal stripe. It has, however, a broad, blackish, lateral line, and the under side of the tail is wholly white. These are features that serve at once to distinguish the two species, aside from the difference of size, relative length of the tail, etc. From all the gray phases of *S. carolinensis*, it is distinguishable by the absence of the subterminal fulvous suffusion of the pelage above, which is constantly present in *S. carolinensis*; by the absence of a white ear-patch; by the coloration of the tail; by the much larger size of the ears; and by other quite obvious differences.

In respect to the skulls of the gray North American *Sciuri* possessing two premolars, namely, *S. fossor*, *S. aberti*, and *S. carolinensis*, the skull of *S. carolinensis* is distinguishable by its narrow elongate form, its smaller size (especially as compared with *S. fossor*), and particularly by the excessive narrowness of the nasal portion and consequently narrower nasals and upper incisors. The chief difference between the skulls of *S. aberti* and *S. fossor* is the much larger size of the skull in *S. fossor*. Two skulls of *S. aberti*, both fully adult (one of them very old), have an average length of 2.30 against an average length of 2.60 in nine skulls of *S. fossor*, the smallest of which (rather young) has a length of 2.52. The first premolar seems to be relatively larger in *S. aberti* than in either *S. fossor* or *S. carolinensis*.

The geographical range of *S. aberti*, as shown by the specimens in the collection of the National Museum, extends from the mountains of Central Colorado southward to the Apache Mountains of Arizona. Its occurrence does not appear to have been reported from any locality outside of Colorado, New Mexico, and Arizona. Its range is hence apparently separated by quite a wide interval from that of *S. fossor*, neither species having been yet reported from either Utah or Nevada.

The *S. castanonotus* of Baird, formerly regarded by Professor Baird as distinct from *S. aberti*, proves to be not separable, even as a geographical

variety. Its chief differential character was the supposed permanent absence of ear-tufts, which additional material shows may be absent or present in specimens from the same locality. I am, in fact, unable to appreciate any differences in the limited material (twenty specimens) before me that are peculiar to particular localities.

TABLE XXXVIII.—Measurements of ten specimens of *SCIURUS ABERTI*.

Catalogue number.	Original number.	Locality.	Sex.	From tip of nose to—				Tail to end of—		Length of—		Height of ear.	Nature of specimen.
				Eye.	Naz.	Occiput.	Tail.	Vertebra.	Hairs.	Fore feet.	Hind feet.		
9430	.....	San Francisco Mts., N. Mex.	.....	.....	.....	2.80	11.00	2.00	12.00	1.75	2.70	.....	Skin.*
.....	.....	Colorado	.....	1.00	2.00	2.50	10.50	2.00	11.00	1.80	2.75	1.00	Alcoholic.
11876	539	Apache Mountains, Ariz.	.....	.....	.....	2.50	9.50	2.00	11.50	1.00	2.70	.....	Skin.
11875	497	.....do	♂	.....	.....	.....	11.00	2.50	10.25	1.70	2.75	.....	do.
11496	A	Camp Apache, Ariz.	.....	1.10	2.00	2.50	11.00	2.00	11.50	1.50	2.75	.....	do.
7917	504	San Francisco Mountains	.....	.....	.....	.....	10.25	2.75	11.00	.....	2.75	.....	do.
11874	17	Mt. Taylor, N. Mex.	♂	1.15	2.15	2.50	.....	2.50	12.00	1.50	2.75	.....	do.
190	.....	Copper Mines, N. Mex.	.....	1.05	1.90	.....	10.25	.....	1.65	2.60	.....	.....	do.
9546	.....	25 miles N. of Santa Fe, N. M.	.....	0.90	1.85	2.25	10.50	2.00	12.00	1.65	2.50	.....	do.
9552	.....	Colorado City, Colo.	.....	1.05	2.00	2.45	10.75	2.25	11.00	1.50	2.60	.....	do.

\* Measurements from Prof. Baird's Man. N. Amer. p. 266.

TABLE XXXIX.—Measurements of two skulls of *SCIURUS ABERTI*.

Catalogue number.	Locality.												
		Total length.	Greatest width.	Distance between orbits.	Nasal bones, length.	Nasal bones, width behind.	Upper incisors from front to back.	Upper incisors from front to hinder margin of palata.	Upper incisors, height.	Upper incisors, width between external edges.	Upper molars, length taken together.	Upper molars, distance between.	Lower jaw, length.
1107	Copper Mines, N. Mex.	2.35	1.33	.....	0.98	0.25	0.67	1.16	0.33	0.23	0.40	0.97	1.35
1108	.....do	2.25	1.30	0.75	0.79	0.20	0.60	1.10	0.37	0.21	0.42	0.98	1.33
													0.63

TABLE XL.—List of specimens examined of *SCIURUS ABERTI*.

Catalogue number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.	Remarks.
11608	.....	.....	♂	Colorado Divide.....	Oct. 1, 1873	Dr. F. V. Hayden.	W. L. Coulter	Skin	Black.
9553	.....	.....	.....	Colorado City, Colo.....	.....	.....	J. Stevenson	.....do	.....do.
9554	.....	.....	.....	.....do.....	.....	.....	.....do	.....do	.....do.
9555	.....	.....	.....	.....do.....	.....	.....	.....do	.....do	.....do.
9549	.....	.....	.....	35 miles north of Santa Fe, N. Mex.	.....	.....	.....do	.....do	.....do.
9550	.....	.....	.....	.....do.....	.....	.....	.....do	.....do	.....do.
9551	.....	.....	.....	Between Taos and Santa Fe, N. Mex.	.....	.....	.....do	.....do	.....do.
9552	.....	.....	.....	.....do.....	.....	.....	.....do	.....do	.....do.
4386	.....	.....	.....	Camp Burgwyn, N. Mex.	.....	Dr. W. W. Anderson	Dr. W. W. Anderson	.....do	.....do.
3518	.....	.....	.....	Fort Union, N. Mex.	.....	Dr. Southworth	Dr. Southworth	.....do	.....do.
9616	.....	.....	.....	Bill Williams's Mountain, N. Mex.	.....	Dr. E. Palmer	Dr. E. Palmer	.....do	.....do.
.....	.....	.....	4	Sierra Mts., N. Mex.	Oct. 23, 1873	Lt. G. M. Wheeler	Dr. J. T. Rothrock	Alcoholic	.....do.
122	1108	.....	.....	Copper Mines, N. Mex.	Winter, 1887	Col. J. D. Graham	J. H. Clark	Skin and skull.	.....do.
121	1107	.....	?	.....do.....	.....	.....	.....do	.....do	.....do.
11696	.....	.....	.....	Camp Apache, Ariz.	Sept. 1, 1873	Lt. G. M. Wheeler	Dr. O. Loew	Skin	.....do.
7819	.....	.....	.....	San Francisco Mts., Ariz.	July 25, 1864	Dr. E. Coues	Dr. E. Coues	.....do	.....do.
9430	.....	.....	.....	.....do.....	.....	Capt. L. Stigrenave	Dr. S. W. Woodhouse.	.....do	.....do.
1189	.....	.....	.....	.....do.....	.....	.....	.....do	.....do	Black.
11876	.....	659	.....	Apache Mountains, Ariz.	Sept. 1, 1873	Lt. G. M. Wheeler	H. W. Henshaw	.....do	.....do.
11875	.....	697	.....	.....do.....	Sept. 4, 1873	.....do	.....do	.....do	.....do.
11874	.....	17	.....	Mount Taylor, N. Mex.	July 5, 1873	.....do	Dr. C. G. Newberry	.....do	.....do.
11873	.....	106	.....	Camp Brown, Ariz.	Oct. 3, 1873	.....do	.....do	.....do	.....do.

## II.—Species inhabiting Mexico, Central and South America.

*SCIURUS COLLLEI* Richardson.

## Collie's Squirrel.

*Sciurus colliei* RICHARDSON, Zool. of the Blossom, 1839, 8, pl. 1.—BACHMAN, Proc. Zool. Soc. Lond. 1838, 95 (without description); Charlesworth's Mag. Nat. Hist. iii, 1839, 334; Amer. Journ. Sci. and Arts, xxxvii, 1839, 307.—WAGNER, Suppl. Schreber's Säuget. iii, 1845, 174.—AUDUBON & BACHMAN, Quad. N. Amer. iii, 1853, pl. elv.—BAIRD, Mam. N. Amer. 1857, 290.

*Macrozous colliei* GRAY, Ann. and Mag. Nat. Hist. 3d ser. xx, 1867, 421 (in part).

? *Sciurus leporinus* AUDUBON & BACHMAN, Proc. Acad. Nat. Sci. Phila. 1841, 101; Journ. Acad. Nat. Sci. Phila. viii, 1842, 314; Quad. N. Amer. i, 1849, 399, pl. xliii.—BAIRD, Mam. N. Amer. 1857, 291.

*Sciurus oculatus* PETERS, Monatsb. K. P. Akad. d. Wissensch. zu Berlin, 1863 (1864), 653.

*Sciurus arizonensis* COUES, Amer. Nat. i, 1867, 357; Proc. Acad. Nat. Sci. Phila. 1867, 134.—COUES & YARROW, Wheeler's Expl. and Surv. West 100th Merid. v, Zool. 1876, 116.

**SPECIFIC CHAR.**—Length from the end of the nose to the base of the tail about 12.50; tail to end of the vertebræ 11.00; tail to end of hairs 14.00. Above, except the middle of the dorsal region, clear gray, without rufous or fulvous suffusion beneath the surface; a broad mesial band extending from the head to the tail mixed yellowish-brown and black; lower parts (usually?)

pure white; no lateral line. Tail long and very broad, vertebrae alone nearly equal in length to the length of head and body; above, deep black, broadly edged with whitish or mixed white, black, and pale fulvous; beneath with or without a broad central area of bright tawny, bordered by a broad subterminal band of deep black, and broadly edged with white. Sometimes the central bright tawny zone can be faintly seen through the hairs of the dorsal surface, as in the Arizona specimens; again it is merely pale fulvous, striped with narrow lines of dusky, the central fulvous area being visible only from the lower surface.

This species is thoroughly distinct from *S. carolinensis*, which it somewhat resembles in color, as it also apparently is from every other North American species of *Sciurus*. It was described by Richardson, in 1839, from a specimen from San Blas, on the west coast of Mexico, in latitude  $21^{\circ} 34'$ , where Mr. Collie found it common. My Mazatlan specimens are from near the same locality (about one hundred miles farther north), and agree with Richardson's original description. Dr. Gray's *S. colliei*, "var. 2", with bright rufous sides and limbs and white belly, I refer with little hesitation to *S. boothii*, while his "var. 1", from the west coast of South America, with "the under surface yellow", he considers the same as Ogilby's *S. variegatoides* and his *S. griseocaudatus*, both of which I refer to the *S. hypopyrrhus* of Wagler. The "*Macroxus colliei*" of Gray seems to be only in small part referable to the *S. colliei* of Richardson.

I refer to this species also the *S. arizonensis* of Coues, described originally from a single specimen obtained at Fort Whipple, Ariz. Two other specimens from Arizona, collected later by Mr. F. Bischoff, agree essentially with Dr. Coues's specimen, except that they are somewhat larger. One of them, however, has the brownish dorsal area less strongly developed than in the others, and has the lower surface considerably varied with irregular patches and streaks of pale yellowish-rufous, thus showing a tendency to the acquisition of a rufous belly, so common a feature among the Squirrels of Mexico and Central and South America. Dr. Coues's specimen, though killed in December, was evidently not full-grown, being, as described by him, of about the size of *S. carolinensis*. The other specimens, one of them a female that had recently nourished young, are much larger, and indicate a species fully as large as *S. aberti*, if not even larger.

The coloration of *S. colliei*, at first sight, seems to bear a close resem-

blance to that of northern specimens of *S. carolinensis*, particularly to those with a large brownish dorsal area. A careful comparison, however, shows the absence of the fulvous suffusion below the surface of the pelage seen in that species, and the absence of any tawny lateral line. The tail also is much longer, and more than one-third fuller and broader, with quite different coloration, being distinctly tricolored below, with the three colors strongly contrasted and sharply defined,—centrally a broad band of bright tawny, nearly two inches wide, with indications of two narrow bars of black within it on each side of the vertebræ; outside of this is a band of deep black, one-half to one inch wide, with, beyond this, a broad clear white margin. The hairs are, many of them, fully three inches in length, so that the tail, measured across the middle from point to point of the outstretched hairs, has a breadth of six inches. The Mazatlan specimens have the tail rather less full, and the bright tawny central area is simply pale fulvous,—a difference of no great importance, in view of the differences in this respect presented by specimens of *S. carolinensis* from even a single locality.

The ears are low, broad, and round, not half as large as in *S. aberti*, and less pointed, shorter, and broader than in *S. fossor*. This species is further distinguished from *S. fossor* by its shorter tail, more brownish-gray color of the upper surface, and by the presence of a yellowish-brown dorsal area, covering nearly all of the back. *S. colliæi* is distinguishable from *S. aberti* not only through the great difference in the size and form of the ears and the absence of ear-tufts, but by lacking the black lateral line, and by the dorsal brownish area being pale yellowish-brown instead of reddish-brown or chestnut. The *S. leporinus* of Audubon and Bachman, from "California", greatly resembles *S. colliæi* in color, size, and form, and is, I have little doubt referable to this species. Its supposed locality is doubtless wrong, being not the present State of California, but from some point farther southward. I have seen, however, a specimen of *S. fossor*, in an evidently abnormal condition of pelage, corresponding quite well with the description of *S. leporinus*. The description of *Sciurus oculatus* of Peters, in respect to size, coloration, relative length of the tail, etc., agrees with the usual phase of *S. colliæi*.

TABLE XLII.—Measurements of eight specimens of *SCIURUS COLLIEI*.

Catalogue-number.	Locality.	Sex.	From tip of nose to—				Tail to end of—		Length of—		Height of ear.	Nature of specimen.	Remarks.
			Eye.	Ear.	Occiput.	Tail.	Vertebra.	Hairs.	Fore foot.	Hind foot.			
0064	Manatlan, Mex.	.....	1.12	2.15	2.35	12.00	11.75	14.00	1.40	2.40	0.62	Skin ..	Measurements quoted from Richardson (l. c.)
0065	do	.....	1.00	2.00	.....	12.00	11.00	14.00	1.40	2.33	0.55	do ..	
.....	San Blas, Cal.	.....	.....	.....	2.50	10.50	8.50	11.00	1.75	2.33	0.65	.....	
6472	Fort Whipple, Ariz.	♀	1.10	.....	.....	9.50	8.50	13.00	1.50	2.30	0.70	Skin ..	
11145	Arizona	♂	1.10	2.05	.....	13.00	10.75	14.00	1.65	2.70	0.65	do ..	
11146	do	♀	1.08	2.05	.....	12.50	9.00	12.00	1.55	2.60	0.60	do ..	Measurements quoted from Peters (l. c.)
1434	Mexico	♀	.....	.....	2.70	12.00	.....	13.30	1.60	2.60	0.77	.....	
2706	do	♀	.....	.....	2.50	10.00	.....	14.55	1.60	2.60	0.72	.....	

TABLE XLIII.—List of specimens examined of *SCIURUS COLLIEI*.

Catalogue-number.	Sex.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.	Remarks.
8775	♀	Fort Whipple, Ariz.	Dec. 30, 1865	Dr. E. Coates	Dr. E. Coates	Skin ..	Type of <i>S. erizonensis</i> Coates.
11145	♂	Arizona	—, 1871	La G. M. Wheeler	Ferdinand Blachoff	do ..	
11146	♀	do	Dec. 5, 1871	do	do	do ..	
9885	.....	Manatlan, Mexico	.....	Ferdinand Blachoff	do	do ..	
9884	.....	do	.....	do	do	do ..	

## SCIURUS BOOTHIÆ Gray.

## Varied Squirrel.

*Sciurus cariegatus* ERXLEBEN, Syst. Anim. 1777, 491 (in part only). Based in part on Buffon's Coquallin (= *Sciurus niger* Linn.), and in part on the *Casticotequallia* of Fernandez (Nov. Hisp. 9), which is unrecognizable as referring to any particular species of red-bellied Mexican Squirrel.—GMELIN, Syst. Nat. i, 1788, 151. Based on Fernandez, Buffon, Erxleben, and Schreber, as above.—SCHREBER, Säuget. iv, 1799, 720, pl. cxxviii. Same as the above.\* Also, here belongs the *Sciurus cariegatus* of compilers generally.

? *Sciurus cariegatus* WIEGMANN, Arch. f. Naturgesch. iii, ii, 1837, 166 (probably in part). SAUNDERS, Rev. et Mag. de Zool. 1861, 4.

? *Sciurus albipes* WAGNER, Abb. der math.-phys. Klasse der K. Bayer. Akad. d. Wissen. 1837, 501.

? *Sciurus varius* WAGNER, Suppl. Schreber's Säuget. iii, 1843, 163, pl. cxxiii D (*S. albipes* on the plate).

*Sciurus richardsoni* GRAY, Ann. and Mag. Nat. Hist. x, 1843, 364 (not *S. richardsoni* Bachman, 1838).

*Sciurus boethkei* GRAY, List Mam. Brit. Mus. 1843, 139 (= *S. richardsoni* Gray, as above); Zool. Voy. Sulphor, 1844, 34, pl. xiii, fig. 1.

*Sciurus fuscovariegatus* SCHINZ, Synop. Mam. 1845, 15 (= *S. richardsoni* Gray, as above).

*Macrozous adelphei* LERSON, Rev. Zool. 1843, 139 (no description); Descrip. de Mamm. et d'Ois. 1847, 141.

*Macrozous pygmaei* LERSON, Rev. Zool. 1843, 139 (no description); Descrip. de Mamm. et d'Ois. 1847, 142.

\* Schreber's description is quoted by Gmelin, although the "Vierter Theil" of Schreber's work bears the date "1792" on the title-page.



*Macrozous boothii* GRAY, Ann. and Mag. Nat. Hist. 2d ser. xx, 1867, 494.

*Macrozous nicoyana* GRAY, Ann. and Mag. Nat. Hist. 3d ser. xx, 1867, 423 (Costa Rica).

*Macrozous collieri* GRAY, Ann. and Mag. Nat. Hist. 3d ser. xx, 1867, 421 (vars. 1 and 2 only).

"*Sciurus intermedius* VERREAUX" (MS. name ?; see Gray, l. c. 421).

*Sciurus rigidus* PETERS, Monatsb. Königl. Preuss. Akad. Wissensch. zu Berlin, 1863 (1864), 652.

**SPECIFIC CHAR.**—Form rather stout; muzzle short and broad; ears rather small; tail narrow, rather longer than head and body; pelage full, coarse, and long. Length of head and body 12.50; of tail-vertebrae 9.75; of tail to end of hairs 12.75. Above, dark brown, mixed with yellowish-gray or black, varied with fulvous; often paler on the sides, where there is a tendency, in many specimens, to a broad, grayish, sub-lateral band; beneath, deep brownish-red, frequently with unsymmetrical patches of pure white. Tail below tricolored, centrally rufous, then black, with a border of white; the rufous in the middle variable in amount and in tint, sometimes obsolete, sometimes forming a broad central band of bright rufous, at other times pale rufous.

This species is so variable in coloration as to be hard to characterize. The above diagnosis indicates a condition intermediate between the extremes, as well as apparently the most common phase. Of eighteen Costa Rican specimens, about half present a quite uniform style of coloration, while of the remainder, no two are very nearly alike. Eleven agree quite nearly in having the general color above black, varied more or less with reddish-brown, the proportion of the two colors varying with each specimen. The ventral surface in all, including the inner side of limbs, is dark reddish-orange. The pelage above is black at base, with a broad subterminal band of fulvous- or rufous-brown, the hairs all broadly tipped with glossy black. The sides of the head, nose, and chin are grayish-brown; the ears have a rufous spot at the base posteriorly. The hairs of the tail are fulvous (in some specimens rufous) at base, ringed with black, then crossed by a broad band of black and narrowly tipped with white. The color of the central portion of the lower surface varies from fulvous to dark brownish-red. Another specimen (No. 11410) is similar to these, but has less black above, and the rufous of the ventral surface is paler; the tail is rufous centrally near the base and toward the tip. No. 11364 has still less black above, and the lower surface is irregularly marked with large patches of pure white. The tail is also much more broadly edged with white, and the ear-patches are also white, as they are in the majority of the specimens before me. No. 9306 differs little from the last, except in having rather less black above, and in a tendency to a pale band

along the sides, midway between the edge of the ventral surface and the middle of the back, and in having rather less white below. In No. 11412, the color of the middle of the back is nearly uniform blackish-brown, with a quite well-marked grayish subdorsal band; the ear-patches are pure white, and there are large areas of white on the ventral surface. In No. 11411, the upper parts are dull faded reddish-brown instead of blackish-brown; the light lateral band is still better marked, and the white below is restricted to a spot at each arm-pit. Four other specimens are similar to the last, except that the lateral band is more or less whitish, and the tail is more broadly edged with white. The white of the lower surface is sometimes confined wholly to the throat and breast, and sometimes forms a narrow, more or less interrupted, mesial line, widening over the posterior part of the ventral surface. In No. 11421, the lower surface is rusty-yellow, with the upper parts paler than in any of the preceding. No. 8506 (from Nicaragua) is wholly pale yellowish-brown above and rusty-yellow below, with white arm-pits. The above-mentioned pale-grayish lateral band is placed high up on the sides, and does not correspond in position with the usual "lateral line" which marks the division of the ventral from the dorsal surface.

As would be expected, these phases of coloration have given rise to numerous synonyms. Lesson's *Macroxus adolphe* and *M. pyladei* seem both referable here, the former agreeing with No. 11364, described above, except that the entire lower parts are white instead of having the white restricted to irregular large patches; the latter (*M. pyladei*) agrees closely with the usual Central Rican phase of this species, in which the ear-patches and the whole lower surface are rufous.\* Both were described from Central American

\* Lesson's above-cited work being rare in American libraries, I append an exact transcript of his descriptions, kindly furnished me by Dr. E. J. Nolan, Secretary of the Academy of Natural Sciences of Philadelphia, from the copy of Lesson's work contained in the Academy's library, the only copy in this country of which I have knowledge:—

"19. L'ÉCUREUIL D'ADOLPHE.

"(*Macroxus Adolphe*, Lesson)

"Cet écureuil, par son faciès, rappelle l'écureuil du *Pylade*, et cependant sa coloration est différente. Le mâle et la femelle ont été tués par mon frère, Adolphe Lesson, dans les forêts qui avoisinent Realajo, dans la province de Nicaragua, du centre-Amérique. Est-ce une variété du suivant ?

"Plus fort que le *pylade*, l'écureuil d'Adolphe a la queue de la longueur du corps, et cette partie a la même nature de poils et la même coloration que le *pylade*, excepté son sommet, qui a une touffe noire et un bouquet blanc terminal. Les poils de cette queue sont roux en dessus, ondulés de noir et terminés de blanc. Le blanc est plus apparent sur les portions latérales et en dessous.

"Le mâle a le dessus de la tête brun tiqueté de gris, le dessous du corps varié de noir luisant et de roux vif par ondulations; le dessus des membres est également varié de roux et de brun; mais les extrémités en dessous sont brunes tiquetées de gris-roux. Deux grosses touffes blanc-neigeux, placées derrière les oreilles, tranchent sur le pelage, et le *pylade* a deux plaques de même forme, rouge-chamois;

specimens. Dr. Gray's *Macroxus collicii* "var. 2" from Guatemala corresponds with the above-described specimens, having a white throat and breast, and more or less white along the middle of the belly. Similar specimens, with perhaps less white below, seem to unquestionably represent the same author's *Macroxus nicoyana* from Costa Rica.

The earliest name applicable beyond question to this species is Gray's *Sciurus boothiae* (= *S. richardsoni* Gray nec Bachman = *S. fuscovariegatus* Schinz), which represents the dark phase, with the middle of the belly white, as in several of the Costa Rican specimens. The *S. variegatus* of Erxleben is probably in part referable to this species, combined perhaps with other Mexican species, but also refers, certainly in part, to the *S. niger* var. *niger* of the United States, and is thus clearly untenable for any species of *Sciurus*. It probably refers fully as well to *S. hypopyrrhus* as to the present species. The *S. variegatus* of De Saussure apparently refers mainly, but not exclusively, to this species. The account of *S. rigidus* of Peters is a good description of the common Costa Rican phase.

This species differs from both *S. hypopyrrhus* and *S. aureigaster* in its stouter form, smaller ears, shorter tail, and *short broad muzzle*, as well as in coloration. They all agree in possessing narrow tails, rather longer than the

toutes les parties inférieures, le dedans des membres, à partir du menton jusqu'à l'anus, sont d'un blanc pur; les joues sont grisâtres, les dents incisives orangées, la peau nue des pattes noire.

"La femelle est aussi forte que le mâle; le dessous du corps a du noir sur la ligne médiane, et le reste tire au gris-brun, et même passe sur les flancs au gris franc.

"20. L'ÉCUREUIL DU PYLADE.

"(*Macroxus Pyladei*, Lesson)

"Les écureuils de la Californie, du Mexique et du Texas, ont entre eux la plus grande analogie de taille, de forme et de coloration. L'espèce que nous décrivons, rapportée, en 1842, des côtes de la Mer du Sud par le docteur Adolphe Lesson, chirurgien-major du brick le *Pylade*, vient encore ajouter à la difficulté de distinguer les diverses espèces admises, et cependant elle est bien distincte, à en juger par les descriptions ou les figures que nous possédons.

"Cet écureuil a été tué dans les arbres de San-Carlos, dans la province de San-Salvador, au centre-Amérique. Sa taille est le double de notre écureuil de France. Sa queue ne dépasse pas les deux tiers du corps; elle est touffue, couverte de longs poils, ceux du dessus noirs, terminés de blanc pur; ceux du dessous roux, puis noirs, et enfin terminés de blanc-neigeux, ce qui lui donne un aspect émaillé noir et blanc. Le pelage sur le corps est varié de noir profond, mélangé par places de poils roux; le dessous de la tête est gris avec du noir sur l'occiput; les oreilles sont bordées de noir; une tache ronde, d'un riche chamois, occupe le derrière de l'oreille; tout le dessous du corps, les quatre membres sont de la nuance roux-chamois la plus intense, excepté les testicules, fort gros, qui sont grisâtres et le pourtour de l'anus, qui est blanc; les parties dénudées des extrémités sont couleur de chair, les ongles sont blanchâtres, le menton et les joues sont grisâtres, les dents incisives orangées; les moustaches sont longues et noires. Je n'ai vu qu'un seul individu de cette espèce, et c'était un mâle, dont l'analogie avec l'écureuil de la Californie de F. Cuvier était fort grande.

"C'est à Realejo, sur la côte de Nicragua, dans l'Amérique du centre, que vit cet écureuil."—  
(Description de Mammifères et d'Oiseaux récemment découverts, précédée d'un Tableau sur les Races Humaines, par M. LESSON, Paris, 1847, pp. 141-143.)

body; but in this species the form is stouter than in either of the others. Though so variable in color, the character of the coloration is quite different in the three forms, as is the nature of the pelage. Possibly additional material will show that some of them (possibly all) intergrade, but the considerable number of specimens before me leave me strongly impressed with their distinctness. The character of the pelage is widely different in each, being soft and full in *S. aureigaster*, longer and coarser in *S. boothia*, and coarser still, sparse, stiff and shining in *S. hypopyrrhus*. *S. hypopyrrhus* is further distinguished by the great length and narrowness of the ears.

TABLE XLIII.—Measurements of nineteen specimens of *SCIURUS BOOTHIÆ*.

Catalogue-number.	Original number.	Locality.	Sex.	From tip of nose to—				Tail to end of—		Length of—		Height of ear.	Nature of specimen.
				Eye.	Ear.	Occiput.	Tail.	Vertebrae.	Hairs.	Fore foot.	Hind foot.		
.....	.....	Costa Rica.....	♂	0.98	1.85	2.90	12.30	9.25	10.75	1.35	.....	.....	Skin.
11368	.....	do.....	♂	1.00	2.00	2.30	12.50	9.75	12.25	.....	2.35	.....	do.
11701	.....	do.....	♂	1.03	1.90	.....	12.50	10.75	13.75	1.37	2.30	0.55	do.
11363	.....	do.....	♂	.....	.....	.....	12.50	9.00	12.75	.....	2.27	0.57	do.
11413	.....	do.....	.....	1.00	1.89	2.17	11.00	9.75	12.00	1.45	2.23	0.50	do.
11411	.....	do.....	♂	0.98	1.98	2.12	10.50	.....	.....	1.45	2.15	0.60	do.
11364	.....	do.....	♂	0.90	1.80	2.05	11.25	.....	.....	1.50	2.25	0.60	do.
8414	.....	do.....	.....	0.98	2.00	2.15	.....	.....	.....	1.50	2.10	0.57	do.
11709	.....	do.....	.....	1.05	2.07	.....	13.50	9.25	12.00	1.45	2.25	0.60	do.
11414	.....	do.....	.....	0.98	1.86	1.90	10.75	.....	.....	1.37	2.22	0.55	do.
11412	.....	do.....	♀	0.94	1.69	2.00	10.75	.....	.....	1.35	2.05	0.55	do.
19054	.....	do.....	.....	1.03	1.95	2.25	11.00	.....	.....	1.35	2.20	0.62	do.
19048	109	do.....	.....	1.03	.....	2.00	11.50	.....	.....	.....	2.27	.....	do.
12019	91	do.....	♂	1.00	2.00	2.30	.....	.....	.....	.....	2.30	.....	do.
12046	85	do.....	.....	1.00	1.85	2.05	.....	9.00	11.25	.....	2.33	0.65	do.
19047	87	do.....	.....	0.95	1.85	2.15	.....	12.50	14.00	1.37	2.45	0.65	do.
11420	.....	West Coast of Central America.....	♂	1.00	2.00	2.30	12.50	.....	.....	1.55	2.30	0.65	do.
11419	.....	do.....	♂	1.05	2.10	2.40	13.25	9.50	12.50	1.45	.....	0.70	do.
8506	.....	Nicaragua.....	♂	1.10	1.85	2.90	12.00	10.00	12.75	1.50	2.45	0.70	do.

TABLE XLIV.—List of specimens examined of *SCIURUS BOOTHII*.

Catalogue-number.	Original number.	Sex.	Locality.	From whom received.	Collected by—	Nature of specimen.
11365	9	♂	Costa Rica.....	J. C. Zeledon.....	J. C. Zeledon.....	Skln.
11366	36	♂	do.....	do.....	do.....	do.
9036	.....	.....	do.....	do.....	do.....	do.
11411	13	♂	do.....	J. Carmiol.....	J. Carmiol.....	do.
11412	14	♀	do.....	do.....	do.....	do.
11413	15	.....	do.....	do.....	do.....	do.
11414	18	.....	do.....	do.....	do.....	do.
11417	.....	.....	do.....	do.....	do.....	do.
8414	.....	.....	do.....	do.....	do.....	do.
11701	.....	.....	do.....	do.....	do.....	do.
11702	.....	♂	do.....	Prof. Wm. Gabb.....	Prof. Wm. Gabb.....	do.
12044	45	.....	do.....	Taimanra Expedition.....	do.....	do.
12046	88	.....	do.....	do.....	do.....	do.
12047	87	.....	do.....	do.....	do.....	do.
12048	109	♂	do.....	do.....	do.....	do.
12049	91	♂	do.....	do.....	do.....	do.
12054	97	.....	do.....	do.....	do.....	do.
11364	5	♂	San Juan.....	Dr. A. von Frantzius.....	Dr. A. von Frantzius.....	do.
11110	.....	♂	West Coast of Central America.....	Capt. J. M. Dow.....	Capt. J. M. Dow.....	do.
11120	.....	♂	do.....	do.....	do.....	do.
11121	.....	.....	do.....	do.....	do.....	do.
8006	.....	♂	Nicaragua.....	James Hepburne.....	James Hepburne.....	do.

## SCIURUS HYPOPYRRHUS Wagler.

## Fire-Bellied Squirrel.

*Sciurus hypopyrrhus* WAGLER, Isis, 1831, 510.—“WAGNER, München. gel. Anzeig. vii, 20”; Suppl. Schreber's Säuget. iii, 1843, 167, pl. cexlii C.—SCHINZ, Syn. Mam. ii, 1845, 20.—BAIRD, Mam. N. Amer. 1857, 282.—DE SAUSSURE, Rev. et Mag. de Zool. 1861, 4.

*Sciurus nigrescens* BENNETT, Proc. Zool. Soc. Lond. i, 1833, 41 (a melanistic form).—BACHMAN, Proc. Zool. Soc. Lond. vi, 1838, 96; Charlesworth's Mag. Nat. Hist. iii, 1839, 334; Silliman's Amer. Jour. Sci. and Arts, xxxvii, 1839, 306.—WAGNER, Suppl. Schreber's Säuget. iii, 1843, 174.—SCHINZ, Synop. Mam. ii, 1845, 19.—AUDUBON & BACHMAN, Quad. N. Am. iii, 1854, 74, pl. cxvii.—BAIRD, Mam. N. Am. 1857, 280.

*Macrozous nigrescens* GRAY, Ann. and Mag. Nat. Hist. 3d ser. xx, 1867, 424.

*Sciurus variegatoides* OGBLEY, Proc. Zool. Soc. Lond. 1859, 117; Ann. and Mag. Nat. Hist. v, 1840, 62.

*Sciurus griseocaudatus* GRAY, Zool. Voy. Sulphur, 1844, 34, pl. xlii, fig. 2 (animal), and pl. xviii, figs. 7-19 (skull and teeth).

*Sciurus dorsalis* GRAY, Proc. Zool. Soc. Lond. 1848, 138, pl. vii (white, with a broad black dorsal stripe).—SCLATER, Proc. Zool. Soc. Lond. 1870, 670.

*Macrozous collicis* “var. 1” GRAY, Ann. and Mag. Nat. Hist. 3d ser. xx, 1867, 421.

*Macrozous dorsalis* GRAY, Ann. and Mag. Nat. Hist. 3d ser. xx, 1867, 422.

*Macrozous maurus* GRAY, Ann. and Mag. Nat. Hist. 3d ser. xx, 1867, 425 (Oaxaca, Mex.).

*Macrozous melania* GRAY, Ann. and Mag. Nat. Hist. 3d ser. xx, 1867, 425.

**SPECIFIC CHARs.**—Size large; form rather slender; ears high and narrow; tail very long, the tail-vertebræ alone equalling the length of the head and body. Length of body 10.50 to 12.50; tail-vertebræ the same; tail to

end of hairs 12.75 to 16.00. Color variable, tending strongly to both albinistic and melanistic phases. Pelage coarse and stiff.

Of the eleven specimens examined, two are almost wholly black; three are black, varied with fulvous, gray, and small unsymmetrical spots of white; four others are black above, strongly varied with pale yellowish-brown, the hairs being black at base and tip, with a broad ring of pale yellowish-brown. The whole lower surface, including the inner side of the limbs, is rusty-yellow. These vary little in color, mainly in respect to the brighter or paler tint of the lower surface and amount of black above.

The three specimens mottled with white (all from Guyaquil, Ecuador) present a very peculiar appearance. One of them (No. 9014) has the pelage everywhere black or dusky at the base, each hair generally with a long silvery white tip, except on the lower part of the back, basal portion of the tail, and hind limbs, where the white of the tips is replaced by yellowish-rusty. The sides of the neck, the fore limbs, and portions of the ventral surface are more faintly washed with a paler tint of the same. The ears and upper surface of the head and of all the feet black, the head and feet faintly varied with rusty. Checks, chin, and throat pale dusky yellowish-brown. Tail, except basal sixth, black, with the hairs broadly white-tipped; at the base, the hairs are rufous-tipped. Top of the head, anterior half of the dorsal surface, and left fore leg with small pencil-like tufts of lengthened white hairs, showing a tendency toward albinism. No. 9093 differs only in being blacker below, with the rufous of the lower part of the back and basal portion of the tail darker and more extended, and with more rufous below, and in having the tufts of white hair more numerous, nearly confluent over the shoulders, and appearing also on the breast, throat, and hind limbs. No. 9392 differs from the last in lacking white patches on the head, in their larger size on the middle of the back, in the right fore limb being wholly white from the elbow to the toes, the latter being black only at the end, and in the rufous on the rump and base of the tail being bright chestnut, or a little stronger even than in No. 9093. No. 7019, from La Union, Central America, and three others from Obispo, Panama, differ from all the preceding in being wholly pale yellowish-rufous below and black above, where the hairs have a yellowish-white subterminal zone, the general effect above being black, conspicuously varied with yellowish-white. The posterior surface of the ears and the whole feet and inner sides of limbs are like the ventral surface. The upper surface of the head is yellowish-gray, sprinkled with black; the cheeks, chin,

and throat pale fulvous. The tail has also the hairs of the lower surface pale yellowish at the base, then black, broadly tipped with white. These specimens, judging from De Saussure's description, are the more common or normal phase of the species. No. 8495, from Nicaragua, is white, except a broad dorsal band, extending from the occiput to the tail, which is intense brownish-black. The hairs of the lower surface of the tail are white at base, then black, broadly tipped with white, giving a wholly pure white surface to the tail throughout. No. 8628, from Costa Rica (about half-grown), has the whole body pale yellow or yellowish-white, with an indistinct brownish dorsal band. The hairs of the tail are wholly black at base, broadly tipped with whitish. Two other specimens, from Southern Mexico, are almost wholly black, being only slightly varied with gray above and on the tail.

This species differs from most other American species in its slenderness, the great length and narrowness of the ears, and the excessive length of the tail, which, with the hairs, is one-fifth to one-fourth longer than the head and body. Dr. Gray's *S. dorsalis* agrees perfectly with the white, black-backed specimen (No. 8495) above described. The *Macroz. melania* of the same author corresponds with the black phase of this species, and his *M. maurus* with the black phase which has the under parts more rufous. De Saussure, in his paper on the Mexican Squirrels (as above cited), describes this species as being usually ferrugineous beneath,\* but gives the following phases of coloration under the head of three unnamed varieties:—*a*, wholly black, with the hairs more or less fulvous at the base; *b*, blackish, with the ventral surface gray, fulvescent, or dusky; *c*, body wholly black.

The original description of Wagler refers to a phase with the lower parts strongly rufous. The length is given as 12 inches from the nose to the end of the tail; the tail (vertebræ only†) as 11.75. Wagner gives the length from nose to base of tail as 12 inches; of the tail-vertebræ 12.09; tail to end of hairs 14.75.

I am quite confident that the *Sciurus nigrescens* of Bennett, described in 1833 as "from that part of California that adjoins Mexico", is referable to the dark phase of the present species. The great length of the tail as compared with the body† renders it almost certain that it can refer to no other

\* "Subtus rufo-ferrugineus, frequenter pilis nigris intermixtis, mento nigrescente."—(Rev. et Mag. de Zool. 1861, p. 5.)

† According to Bennett, head and body 10.50; tail-vertebræ 10.50; tail to end of hairs 14.00; or, according to Bachman's measurements of the same specimen, head and body 12.37; tail to end of hairs 15.37.



known species, the tail being about three inches longer than the body,—a proportion found in no other Mexican Squirrel. The general size, as well as the narrowness of the tail, gives further evidence of its correct reference being here. There are, furthermore, two specimens in the collection that agree fully with Bennett's description, which I have no hesitation in referring to this species.

The *Sciurus variegatoides* of Ogilby and the *Sciurus griseocaudatus* of Gray, from the "west coast of South America", I am convinced are both referable to this species, and hence also Gray's "var. 1" of Gray's *Macroxus colliæi*. They agree closely with the specimens from Panama and La Union.

The *Sciurus varius* and *S. socialis* of Wagner were referred by Wiegmann to this species, as I think, incorrectly. The former seems to more nearly agree with *S. boothiæ*, while the latter I am unable to identify.

This seems to be a common species in Southern Mexico and Central America southward to Ecuador, and presents, as noted above, widely varying phases of coloration.

In several specimens of this species, in which the dentition could be examined, there were generally found two upper premolars, but two out of four alcoholic examples had only one.

TABLE XLV.—Measurements of eleven specimens of *SCIURUS HYPOPYRRHUS*.

Catalogue-number.	Locality.	Sex.	From tip of nose to—				Tail to end of—		Length of—		Height of ear.	Nature of specimen.
			Eye.	Ear.	Occiput.	Tail.	Vertebra.	Hairs.	Fore foot.	Hind foot.		
3092	Guayaquil, Ecuador .....	♀	1.10	8.00	.....	12.50	19.00	14.25	1.50	2.30	0.85	Skin.
3093	.....do .....	♂	6.93	1.80	.....	13.25	13.75	16.25	1.50	2.35	1.00	.....do.
9014	.....do .....	♂	1.10	1.98	2.42	12.50	11.00	13.50	1.45	2.35	0.80	.....do.
7019	La Union, Central America .....	♂	1.18	1.98	2.38	13.35	13.25	15.50	1.55	2.40	0.76	.....do.
8405	Nicaragua .....	♂	1.12	2.20	2.52	13.00	11.00	13.75	1.75	2.55	0.70	.....do.
1699	San José, Costa Rica .....	♂	1.12	2.20	2.52	13.00	9.75	12.00	1.35	2.25	0.75	.....do.
7005	Coahuila, Mexico .....	♂	1.00	2.10	2.45	13.00	.....	.....	1.45	2.45	0.78	.....do.
4980	Mexico (Gulf coast) .....	♀	1.90	2.90	2.85	11.25	11.25	15.65	1.55	2.40	0.80	Alcohol.
3646	Obispo, Panama .....	♀	1.65	2.00	2.27	16.40	10.40	12.85	1.65	2.50	0.90	.....do.
3645	.....do .....	♀	6.95	1.90	2.45	10.25	10.00	.....	1.55	2.45	0.95	.....do.
3643	.....do .....	♀	1.13	2.07	2.47	10.25	10.35	13.90	1.65	2.47	0.95	.....do.

\* In Museum of Comparative Zoology, Cambridge, Mass.



TABLE XLVI.—List of specimens examined of *SCIURUS HYPOPYRRHUS*.

Catalogue-number.	Sex and age.	Locality.	From whom received.	Collected by—	Nature of specimen.
9309	♀	Guyaquil .....	Dr. Destrange .....	Dr. Destrange .....	Skln.
9303	♂	do .....	do .....	do .....	do
9014	♂	do .....	do .....	do .....	do
9038	♂	San José, Costa Rica .....	Dr. A. von Frantzen .....	José Zelandon .....	do
8495	♂	Nicaragua .....	James Hepburn .....	James Hepburn .....	do
7019	♂	La Union, Central America .....	Capt. J. M. Dow .....	Capt. J. M. Dow .....	do
7305	♂	Goanacoalco, Mexico .....	F. Samichrath .....	F. Samichrath .....	do
*4366	♂	Mexico (Gulf coast) .....	Commodore Perry .....	do .....	Alcohol.
*3040	♂	Obispo, Panama .....	Hassler Expedition .....	Hassler Expedition .....	do
*2645	♂	do .....	do .....	do .....	do
*3643	♂	do .....	do .....	do .....	do

\* In Museum of Comparative Zoology, Cambridge, Mass.

*SCIURUS AUREIGASTER* F. Cuvier.

## Red-bellied Squirrel.

*Sciurus aureogaster* F. CUVIER, Hist. des Mam. iii, livr. lix, 1829 (with a figure).—BACHMAN, Charlesworth's Mag. Nat. Hist. iii, 1838, 158.—WAGNER, Suppl. Schreber's Säuget. iii, 1843, 165.—SCHINZ, Synop. Mam. 1845, 7.—HAIRD, Mam. N. Am. 1857, 989 (from Cuvier).—GRAY, Ann. and Mag. Nat. Hist. 3d ser. xx, 1867, 423.

♀ "*Sciurus leucogaster* F. CUVIER, Mam. i, 1831, 300."

*Sciurus ferrugineiventris* AUDUBON & BACHMAN, Proc. Acad. Nat. Sci. Phila. 1841, 101; Journ. Acad. Nat. Sci. Phila. viii, 1842, 313; Quad. N. Am. i, 1849, 292, pl. xxxviii.—BAIRD, Mam. N. Am. 1857, 281 (from Audubon and Bachman).

*Macrozus aureogaster* GRAY, Ann. and Mag. Nat. Hist. 3d ser. xx, 1867, 423.

*Macrozus morio* GRAY, Ann. and Mag. Nat. Hist. 3d ser. xx, 1867, 424.

*Eureuil de la Californie ou à ventre doré*, F. CUVIER, Hist. des Mam. iii, livr. lix, 1829.

**SPECIFIC CHARs.**—Head and body about 10.50; tail-vertebræ 8.50 to 9.00; tail to end of hairs about 11.50, rather longer than head and body. Pelage soft and full. Above, including the head, clear dark gray; beneath, deep reddish-orange, which blends with the gray of the sides, and often extends high up on the sides at the shoulders, sometimes meeting on the back, where, however, it is generally more or less mixed with gray. Sides of the head and chin light gray. Tail tricolored below, centrally deep reddish-orange, then black, and white-edged; upper surface mixed black and white.

The color varies greatly in different individuals, but less so than in most of the other Mexican Squirrels, the chief variation being in the direction of melanism. The gray, however, varies from whitish-gray to dark iron-gray,

and the rufous tint of the lower parts from reddish-orange to strong reddish-brown or fiery-chestnut. One specimen (No. 7205) is wholly black, very minutely sprinkled on the sides with reddish-gray; the hairs of the tail wholly black to the base. Another (No. 3923) is dusky, with the middle of the back, the feet, most of the head, the ears, and the tail black; sides and most of the dorsal surface varied with pale reddish-brown; lower parts mixed black and rufous. Another (No. 8489) is blackish above, varied with white, with a faint rufous tinge across the shoulders; whole top of the head, feet, and exterior of hind limbs black, the former slightly varied with whitish; cheeks and chin gray; whole lower surface intense orange-red; tail below wholly black, except a narrow mesial line of mixed rufous and black toward the base; upper surface of tail mixed white and black. In No. 7203, the red of the lower surface extends high up on the sides, meeting over the shoulders, and more or less tinges the whole dorsal surface, except the head, which is clear blackish-gray. Tail centrally more or less red below. In No. 7847, the lower surface is fiery-orange, which color impinges upon the dorsal surface at the shoulders, not, however, extending quite to the median line. The rest of the dorsal surface is clear blackish-gray. Tail below broadly centred with rufous. In No. 7848, the colors have the same distribution, but the gray of the upper parts is lighter, the white predominating over the black. The middle of the tail below is deep reddish-brown throughout, bordered by a broad band of black, and edged and tipped with white. In No. 3262, the posterior half of the back is nearly white. In No. 6352, while the distribution of the color is the same as in No. 7848, the color below is dark red, which prevails over the shoulders with almost the same intensity as below.

Except where the tints are obscured by melanism, the pattern of the coloration remains quite constant, the variation being mainly in reference to the varying proportions of black and white of the upper parts, in the intensity of the red of the lower surface, and in the extent of its encroachment upon the dorsal surface.

The *Sciurus aureogaster* of F. Cuvier, as shown by the description and figure, especially the latter, refers unquestionably to this species. The *S. aureogaster* of Gervais, however, is an entirely different animal, namely, the *Macroxus leucops* of Gray, as is shown in the discussion of the synonymy of that species. F. Cuvier's *S. leucogaster*, the description of which I have not seen, is referred by Baird and others to Cuvier's *S. aureogaster*.

Audubon and Bachman's figure of their *Sciurus ferruginiventris* is also an excellent representation of the average phase of this species, to which their description is unequivocally applicable. The locality of "California" is undoubtedly erroneous. As Professor Baird has remarked, the species of Squirrels described by these authors as "*probably* from California", nearly all came from Mexico or from points far south of the present State of California.

To this species is doubtless referable Dr. Gray's *Macrozous morio*, from an unknown locality.

The specimens in the collection are mostly from the provinces of Vera Cruz and Oaxaca in Southeastern Mexico; one, however, is from Guatemala. On one of the labels is written, probably by the collector, Professor Sumichrast,—“The common species of *Sciurus* of the tierra caliente of the east coast.” Dr. Gray also cites examples from Colombia, which, he says, were received from Parzudaki and Verreaux, as the *S. aureogaster* of F. Cuvier.

TABLE XLVII.—Measurements of nine specimens of *SCIURUS AUREIGASTER*.

Catalogue-number.	Original number.	Locality.	Sex.	From tip of nose to—				Tail to end of—		Length of—		Height of ear.
				Eye.	Ear.	Occiput.	Tail.	Vertebrae.	Hairs.	Fore foot.	Hind foot.	
7848	8	Orizaba, Mexico.....	♂	1.00	1.80	.....	11.00	8.50	11.95	1.00	2.30	0.70
7804	14	.....do.....	♂	0.85	1.58	.....	8.00	9.00	10.50	1.50	2.30	0.50
7847	7	.....do.....	♀	1.10	1.85	.....	11.50	8.50	12.00	1.55	2.50	0.60
7803	14A	.....do.....	♂	0.95	1.75	.....	10.00	8.25	11.07	1.53	2.25	0.64
9533		Tehuantepec, Mexico.....	♂	1.03	2.10	.....	.....	.....	.....	1.53	2.25	0.70
8489	30	Cordova, Mexico.....	♂	0.90	1.65	.....	8.50	9.00	11.00	1.00	2.70	0.54
6353-1		Mirador (near Vera Cruz), Mexico.....	♀	.....	.....	.....	11.00	8.50	11.65	.....	2.35	0.55
3902		Mexico.....	♂	0.95	1.85	2.05	10.00	9.00	11.95	1.45	.....	0.50
1156		Guatemala.....	.....	1.05	1.90	2.15	10.00	8.00	11.00	1.70	2.00	.....

TABLE XLVIII.—Measurements of three skulls of *SCIURUS AUREIGASTER*.

Catalogue-number.	Locality.	Sex.	Total length.	Greatest width.	Distance between orbits.	Nasal bones, length.	Nasal bones, width behind.	Upper incisors from front to median.	Upper incisors from front to hinder margin of palate.	Upper molars, length taken together.	Upper molars, distance between.	Lower jaw, length.	Lower jaw, height.
8050	Orizaba, Mexico.....	.....	2.44	1.30	.....	0.73	0.94	0.78	1.15	0.46	0.30	1.46	0.60
8053	.....do.....	♂	2.08	1.05	0.80	0.60	0.78	0.65	1.07	0.38	.....	1.22	0.67
8065	Santa Efigenia, Tehuantepec.....	.....	2.43	1.40	.....	0.80	0.94	0.78	1.25	0.45	0.30	1.45	0.60

\* Rather young.

TABLE XLIX.—List of specimens examined of *SCIURUS AUREIGASTER*.

Catalogue-number of skin.	Catalogue-number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
7803	.....	14A	.....	Orizaba, Mexico	.....	Prof. F. Sumichrast	Prof. F. Sumichrast	Skin.
7804	.....	14	♂	do	.....	do	do	do.
7847	.....	7	♀	do	.....	do	do	do.
7848	.....	8	.....	do	.....	do	do	do.
.....	0909	.....	.....	do	.....	do	do	Skull.
.....	0953	.....	.....	do	.....	do	do	do.
.....	0965	.....	.....	do	.....	do	do	do.
9353	.....	.....	.....	Tehuantepec, Mexico	.....	do	do	do.
9460	.....	30	♂	do	.....	do	do	Skull.
9091	.....	.....	.....	Cordoba, Mexico	Feb. 1891	do	do	do.
3082	.....	.....	.....	Mexico	.....	H. de Sausure	H. de Sausure	do.
3209	.....	.....	.....	do	.....	do	do	do.
.....	.....	.....	.....	do	.....	Verreaux Frères	Verreaux Frères	do.
3289	.....	.....	.....	Mirador (near Vera Cruz), Mex.	.....	Dr. C. Sartorius	Dr. C. Sartorius	do.
3254	.....	.....	.....	do	.....	do	do	do.
3255	.....	.....	.....	do	.....	do	do	do.
1150	.....	.....	.....	Guatemala	.....	Boston Soc. Nat. Hist.	Dr. von Fatten	do.

\* Dusky.

## SCIURUS LEUCOPS (Gray) Allen.

## Golden-bellied Squirrel.

*Sciurus aureogaster* GEOFFROY, Voyage de la Vénus, Zool. 1855, 156, pla. x, xi (not of F. Cuvier, 1809).? *Sciurus hypozanthus* LICHTENSTEIN, MS. (see Geoffroy, l. c. 158).*Macrozous griseoflavus* GRAY, Ann. and Mag. Nat. Hist. 3d ser. xx, 1867, 427.*Macrozous leucops* GRAY, Ann. and Mag. Nat. Hist. 3d ser. xx, 1867, 427.

**SPECIFIC CHARs.**—Length of body and head about 12.50; tail-vertebræ 9.75; tail with hairs 12.00 to 13.00, about equal to the length of the head and body, but narrow. Pelage full and soft. Above, gray, varying from whitish-gray to dark iron-gray, generally with a large patch of yellowish-rusty on the nape and a large area of the same color on the rump; beneath, pure white, yellowish-white, or deep golden-yellow. Pelage of the whole upper surface generally with a broad subterminal band of yellowish or golden, sometimes showing faintly through the surface.

Of three specimens from Tehuantepec, Mexico, two are white below, faintly stained with yellow, while the other has the lower parts deep orange-yellow. One (No. 9432) has the nape-patch chestnut and sharply defined; the rump-patch is faintly developed. In another (No. 9434), the nape-patch is well defined but paler, and the rump-patch is also only faintly indicated.

In the third (No. 9433), the nape-patch is strongly colored, but is more extended and not sharply defined; the rump-patch, as in the others, is partly hidden by the gray tips of the hairs. These all have the hairs of the tail orange-yellow at base, with a broad subterminal zone of black, and broadly tipped with white. The yellow of the base is traversed by a narrow line of black.

Three other specimens, from the Sierra Madre Mountains, Durango, have each the chestnut nape and rump patches sharply defined, the latter very large. The general color above is pure dark gray, and that of the ventral surface pure white. The pelage of the dorsal surface is generally ringed subterminally with rufous, but there are many rufous hairs intermixed with the gray. In two of these specimens, the tail presents no yellow, the hairs being banded with black and white. In one (No. 7176), the hairs of the tail have a faint wash of yellow at the base. This specimen very closely resembles the right-hand figure of Geoffroy's Plate X in the Zoölogy of the Voyage of the *Vénus*. No. 9434, from Tehuantepec, corresponds with the other figure of the same plate, while No. 9433 might apparently have served as the original of the figure given in Plate XI of the same work.

This species was first described in 1855 by Is. Geoffroy, from specimens obtained at Monterey by the naturalist of the *Vénus*, but erroneously referred to the *S. aureogaster* of F. Cuvier. Geoffroy, in his article on this species, refers to its great variability in color, some of the specimens examined by him being clear white beneath, others grayish-white, while others had the same parts varied with rufous and white. Dr. Gray's *Macroxus griseoflavus* and his *M. leucops* are unquestionably, I think, referable to this species.

The *M. leucops* agrees well with Geoffroy's figures and description of his *S. aureogaster*; the *M. griseoflavus* better with my Durango specimens, except that the nape-patch is not mentioned. In both, the hairs of the back are lead-colored at the base, broadly ringed with brown, with a narrow subterminal ring of black and a white tip, while *M. leucops* has the "crown, nape, and rump yellow-washed"; the lower surface in *griseoflavus* is "yellow-red", in *leucops* "bright red". Geoffroy says, of the upper parts, "mais le gris n'est pas pur, les poils, noirs à leur base, blancs à leur pointe, ayant une zone intermédiaire rousse qui se montre un peu au dehors, et jette sur l'ensemble du pelage une légère nuance rousse. Sur la croupe et la nuque le roux devient même dominant."

Lichtenstein's MS. name *hypoanthus* has of course priority over both, but seems not to have been published except through this incidental reference to it by Geoffroy; and indeed there is no proof that the specimens so named were not referable to the true *aureogaster* of F. Cuvier.

Dr. Gray's *M. griseoflavus* and *M. leucops* are both described on the same page; and, although *griseoflavus* stands first, I adopt the name *leucops* as agreeing better with the specimens figured and described by Geoffroy, while they come also from substantially the same locality; but I at the same time believe *griseoflavus* to be specifically the same, notwithstanding the more uniform coloration of the dorsal surface.

A comparison of Geoffroy's description and figures with those given by Cuvier shows at once the wide differences between them, which Geoffroy himself thus notices:—"En comparant cette description à celle de M. Frédéric Cuvier ou à l'un des individus qui nous sont venus en 1829 et en 1831 de la Californie et du Mexique, on reconnaitra immédiatement de nombreuses et remarquables analogies avec ceux-ci, mais aussi de notables différences. L'Écureuil de la *Vénus*, en même temps qu'il manque inférieurement de la couleur rousse qui serait caractéristique pour l'espèce selon les auteurs, plus de roux sur les parties supérieures; et cela, non-seulement sur la croupe et la nuque où le roux domine, mais même sur le dos, où les poils ont une zone rousse dont d'autres individus ont à peine un vestige. L'Écureuil de la *Vénus* ne devrait-il donc pas être considéré comme une espèce voisine, mais distincte du *Sciurus aureogaster* ou *hypoanthus*?" He refers to the wide range of individual variation presented by several well-known species, and is influenced by this in referring the specimens collected by the *Vénus* to Cuvier's *S. aureogaster*.

In size and proportions, there is little difference between the present species and *S. aureogaster*, but the difference in coloration is so pronounced and of such a character as to leave little doubt of their distinctness. In *S. aureogaster*, the hairs of the dorsal surface have, in some specimens, a pale central narrow ring of rust, but often the hairs are wholly black beneath the surface and merely narrowly tipped with white. None of the sixteen specimens of *S. aureogaster* before me show any approach to any of the six specimens of *S. leucops*, yet more abundant material may show that they are not specifically separable. Among the specimens from Tehuantepec are typical representatives of both forms.

The habitat of this species, so far as known, is confined to Southern Mexico and Guatemala.

TABLE L.—Measurements of six specimens of *SCIURUS LEUCOPS*.

Catalogue-number.	Original number.	Locality.	Sex.	From tip of nose to—				Tail to end of—		Length of—		Height of ear.	Nature of specimen.
				Eyes.	Ears.	Occiput.	Tail.	Vertebrae.	Hairs.	Fore foot.	Hind foot.		
9434	37	Tehuantepec, Mexico .....	♂	1.05	1.95	2.25	11.50	9.75	13.00	1.70	2.40	0.75	Skin.
9438	25	do .....	♀	1.10	1.85	2.30	11.50	9.00	12.90	1.58	2.30	0.80	do.
9433	96	do .....	.....	1.10	2.00	2.42	11.50	9.00	12.25	1.58	2.25	0.60	do.
7176	3008	Rio de Coahuayana, Mexico .....	.....	.....	.....	.....	11.25	8.75	12.90	1.35	2.25	0.60	do.
7177	477	Sierra Madre, Mexico .....	♂	.....	.....	.....	11.00	8.50	11.75	1.65	2.35	0.50	do.
8501	519	do .....	♂	.....	.....	.....	11.00	9.50	12.90	1.58	2.35	.....	do.

TABLE LI.—List of specimens examined of *SCIURUS LEUCOPS*.

Catalogue-number.	Original number.	Sex.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
8501	519	♂	Sierra Madre, Durango, Mexico	Apr., 1863	John Xantus	John Xantus	Skin.
7177	477	♂	do	.....	do	do	do.
7176	3008	.....	Rio de Coahuayana, Mexico	.....	do	do	do.
9434	30	♂	Tehuantepec, Mexico	.....	Prof. F. Sumichrast	Prof. F. Sumichrast	do.
9432	25	♀	do	.....	do	do	do.
9433	96	.....	do	.....	do	do	do.

## SCIURUS ÆSTUANS Linn.

### Brazilian Squirrel.

#### Var. ÆSTUANS.

*Sciurus brasiliensis* MARCGRABE, Hist. Nat. Bras. 1643, 230.—BRISSON, Rôgn. Anim. 1766, 164.

*Sciurus æstuanus* LINNÆUS, Syst. Nat. i, 1766, 88.—ERZLEBEN, Syst. Reg. Anim. 1777, 421.—GMELIN, Syst. Nat. i, 1788, 151.—SCHREBER, Säuget. 1792, 787.—KÜHL, Beiträge, 1800, 68.—DESMAREST, Mamm. 1822, 337.—GRIFFITH'S Cuvier, v, 668.—MAXIMILIAN, Beiträge z. Naturgesch. Brasil. ii, 1826, 430.—FISCHER, Synop. Mamm. 1829, 350.—WAGNER, Suppl. Schreber's Säuget. iii, 1843, 186.—TSCHUDI, Fauna Peruana, 1844-46, 158.—SCHIKZ, Syn. Mamm. ii, 1845, 17.—GIEBEL, Säuget. 1855, 652.

*Macrozous æstuanus* "F. CUVIER, Dict. Sci. Nat. x [1818], 248".—LESSON, Man. des Mamm. 1827, 238.—GRAY, Ann. and Mag. Nat. Hist. 3d ser. xx, 1867, 432.

*Sciurus æstuanus* var. *guianensis* PETERS, Monstab. K.-P. Akad. zu Berlin, 1863 (1864), 655.

? *Sciurus pusillus* "GEOFFROY, Coll. Mus."—DESMAREST, Nouv. Dict. d'Hist. Nat. x, 1817, 109; Mamm. 1829, 337 (Cayenne; young?).—FISCHER, Synop. Mamm. 1829, 350.—WAGNER, Suppl. Schreber's Säuget. iii, 1843, 187.

? *Macrozous pusillus* LESSON, Man. des Mamm. 1827, 238.—GRAY, Ann. and Mag. Nat. Hist. 3d ser. xx, 1867, 433.



- Sciurus gilcigularis* NATTERER, MS.—WAGNER, Wieg. Aroh. f. Natarg. 1843, ii, 43, 1845, i, 148; Abhand. d. K.-B. Akad. d. Wissensch. v, 1850, 279 (from near the mouth of the Rio Madeira, Brazil).—GIEBEL, Säget. 1855, 653 (from Wagner).  
*Sciurus guerlingus* CASTELNAU, MS. (= *Macrozous leucogaster* Gray; see Gray, l. c.).  
*Macrozous leucogaster* GRAY, Ann. and Mag. Nat. Hist. 3d ser. xx, 1867, 430.  
*Macrozous fasciatus* CASTELNAU, MS.—GRAY, Ann. and Mag. Nat. Hist. 3d ser. xx, 1867, 432.  
*Macrozous kuhlii* GRAY, Ann. and Mag. Nat. Hist. 3d ser. xx, 1867, 433 (= *Sciurus leucotis* Castelnau, MS.).  
*Myoxus guerlingus* SHAW, Gen. Zool. ii, 1801, 171, pl. 156.  
*Brazilian Squirrel*, PENNANT, Quad. 1771, 286.  
*Le Grand Guerlinguet*, BUFFON, Hist. Nat. Suppl. vii, 1789, 261, pl. lxx.  
*Le Petit Guerlinguet*, BUFFON, Hist. Nat. Suppl. vii, 1789, 63, pl. xli.  
*Guerlinguet*, SHAW, Gen. Zool. ii, 1801, 171.  
*Cachin gélé*, Vulgo.

## Var. RUFONIGER.

- Sciurus rufoniger* PUCHERAN, Rev. de Zool. 1945, 338 (Santa Fé de Bogotá).  
*Sciurus chrysuros* PUCHERAN, Rev. de Zool. 1945, 337 (Santa Fé de Bogotá).  
*Sciurus æstuanus* var. *hoffmanni* PETERS, Monatsb. Akad. Wissensch. Berlin, 1863 (1864), 654 (Costa Rica).  
*Sciurus hyporhodus* GRAY, Ann. and Mag. Nat. Hist. 3d ser. xx, 1867, 419.  
*Macrozous irroratus* GRAY, Ann. and Mag. Nat. Hist. 3d ser. xx, 1867, 431 ("Upper Ucayali, Brazil").  
*Macrozous griseogena* GRAY, Ann. and Mag. Nat. Hist. 3d ser. xx, 1867, 429 (Mexico, Honduras, Costa Rica, Panama, Santa Fé de Bogotá); ib. 4th ser. xi, 1873, 469.

## Var. ÆSTUANS.

**VARIETAL CHAR.**—Length of head and body 7.00 to 8.00 inches; of tail-vertebræ a little less (about 6.75 to 7.50); to end of hairs about 9.00 to 9.50. Ears of medium size, rounded; tail narrow, distichous till near the end, where it is more cylindrical. Pelage soft, short. General color above dark olivaceous-brown, minutely varied with fulvous or pale rufous; below, including inside of the limbs, generally reddish-yellow, varying from pale rufous to yellowish-gray. Sometimes with the yellow restricted to the breast and the middle of the anterior half of the lower surface; or the whole lower surface is whitish, washed with fulvous. Above, with the middle of the back, sometimes darker than the rest of the dorsal surface. Tail yellowish-brown, ringed with black (the subterminal black bar very broad), and washed with pale grayish-yellow. The general color of the tail is blackish, washed with pale whitish-yellow. The outer surface of the feet is usually colored like the back. The ears are generally reddish; the eye is ringed with brownish-yellow. The sides of the muzzle, the chin, and throat are yellowish-white.

This variety presents no very striking variations in color, and seems to vary but little with locality. I have noticed no tendency to melanism, and no melanistic specimens appear to have been met with by previous authors. The subjoined table of measurements of fifteen specimens, nearly all (thirteen) taken from alcoholic examples, shows only a very moderate range of variation. The specimens are nearly all from Southern Brazil, and are quite uni-



form in coloration, varying mainly in respect to the tint of the lower surface, which ranges from yellowish-white to reddish-yellow. The upper surface, though presenting a small amount of variation in comparison to that shown by the Central American and Mexican species, varies considerably in respect to the general tone of the color. The hairs are generally plumbeous or dusky at base, ringed first with yellowish-brown and then with black, with yellowish tips. The hairs are thus twice ringed with black and yellowish. The general color varies from mixed yellowish-gray and black to mixed reddish-brown and black, with sometimes the middle of the back distinctly darker than the sides.

Var. RUFONIGER.

VARIETAL CHARs.—Larger than var. *æstuans*. Length of body about 8.75; of tail-vertebræ about 7.00 to 7.75; of tail to end of hairs 9.00 to 9.75. Scarcely different in coloration from var. *æstuans*, except that the dorsal surface is rather darker and redder and the lower parts rather lighter; the tail is also washed with yellowish-red instead of very pale yellow, while the black rings are broader and darker.

In respect to the general coloration of the body, these two forms are sometimes quite indistinguishable, but the coloration of the tail is generally strikingly different; the size of the northern form seems also to be uniformly larger. Occasionally, specimens of var. *æstuans* are of just the same tint above as var. *rufoniger*, but generally var. *rufoniger* is redder and darker, the middle of the back being frequently quite blackish, the hairs being ringed with reddish-yellow and black instead of pale or grayish-yellow and black, with the subterminal black ring broader.

Among the twenty-five or more specimens of var. *rufoniger* in the collection (nearly all from Costa Rica), the range of color-variation is very limited, the dorsal surface varying only in respect to the amount and intensity of the rufous, and in respect to whether the middle of the dorsal region is concolor with the rest of the dorsal surface, or more or less darker. The lower surface varies from dull pale reddish-fulvous to deep bright orange. The tail varies only in respect to the tint of the reddish edging, which is sometimes yellowish-red, but generally reddish-orange, and not unfrequently dark reddish-brown. The very small inconspicuous ear-patch varies from white or yellowish-white to reddish-fulvous. The outside of the limbs and the upper surface of the feet are generally colored like the dorsal surface;

the inner side of the limbs like the belly; sometimes, however, the feet are colored like the belly, the color of the ventral surface also sometimes invading the outer surface of the limbs. The sides of the face and chin vary from grayish-brown to deep yellow or orange.

Specimens from Venezuela are smaller, and are undistinguishable from var. *æstuans* above, but still retain the bright-red edging of the tail, which is, however, lighter or more golden than in Costa Rica specimens. This form appears to extend, with very slight modifications, southward through New Granada to Eastern Peru.

GENERAL REMARKS UPON SCIURUS ÆSTUANS AND ITS VARIETIES.

**DIFFERENTIAL CHARACTERS.**—The two varieties of *Sciurus æstuans* differ in the larger size and more reddish coloration of the northern form, and especially in respect to the color of the tail. Var. *rufoniger* averages fully an inch longer than var. *æstuans*; the color is much more rufous, the tail broadly edged with red instead of narrowly edged with pale yellow, and the ventral surface is deep reddish-orange instead of reddish-yellow. In the tables of measurements, the tail appears to be relatively the shorter in var. *rufoniger*, but the difference is not real. In the case of var. *æstuans*, the measurements were taken from specimens preserved in alcohol, while the measurements of var. *rufoniger* were taken from skins, from the tails of which the vertebrae had generally been removed, leaving merely the shrunken distorted skin.

**SYNONYMY AND NOMENCLATURE.**—Linnæus's description of *Sciurus æstuans* was based on specimens from Surinam, and is the same animal as the *S. brasiliensis* of Marcgrave and Brisson. The name *æstuans* is the one by which the Brazilian Squirrel has generally been recognized by authors. For a long time, the only prominent synonym was *pusillus*, a MS. name given by Geoffroy to young specimens from Cayenne, in the Paris Museum, which name appears to have been first published by Desmarest in 1817. This is also the origin of Buffon's "*Petit Guerlinguet*", and the *Écureuil nain* of other French authors. For many years, these names all uniformly referred to the original example in the Paris Museum.\* Gray, in 1867, referred to a second specimen, "four and a half inches long" (head and body), as being in the British Museum, from "Tropical America". I have before me another, from Brazil, which I believe to be only a very young example of *S. æstuans*,

\* "Il se trouve à Cayenne; c'est de là que Laborde envoya à Buffon le seul individu qui, jusqu'à présent, ait été décrit."—(F. CUVIER, *Dict. des Sciences Nat.* tom. xiv, 1819, p. 248.)

although in size and coloration it agrees perfectly with the descriptions of *S. pusillus*.\*

The next synonym of the Brazilian Squirrel (var. *æstuans*) is the *S. gilvularis* (Natterer, MS.), a species first described by Wagner in 1843, based on specimens from the mouth of the Rio Madeira, having the chin and throat ochre-yellow. This form he regarded as the northern representative of the *S. æstuans* of Southern Brazil. In 1863, Peters gave the varietal name *guianensis* to specimens from British Guiana, also immature, though much larger than the *S. pusillus* of Geoffroy. Two of the numerous nominal species described by Dr. Gray, namely, *S. flaviventer* and *S. kuhlii* from "Brazil", are also undoubtedly referable to var. *æstuans*, as is also his *M. leucogaster* from Eastern Bolivia.

The first name applicable to the northern form of *Sciurus æstuans* seems to be the *rufoniger* of Pucheran, given in 1845 to specimens from Santa Fé de Bogotá. In the same article, the name *chrysurus* was given to other specimens from the same locality. The first name was applied to examples having the middle of the body dark, the sides reddish, the chin and throat gray, and the tail ringed with red and black; the second to specimens with the dorsal surface uniformly colored, the throat yellow, and the tail washed with golden. To the extreme phase of this species, as developed in Costa Rica, Peters, in 1864, applied the varietal name *hoffmanni* (*Sciurus æstuans* var. *hoffmanni*), in which the size is rather larger and the colors stronger, especially the rufous, than in the New Granada specimens. Gray's *Sciurus hyporrhodus*, described in 1867, was based also on specimens from Santa Fé de Bogotá, apparently in full winter pelage, which are unquestionably referable to the form previously named by Pucheran. His description applies in every detail to numerous specimens before me from Costa Rica. Gray's *Macroxus irroratus*, from the Upper Ucayali, Eastern Peru, also belongs here, showing that this rufous form of *Sciurus æstuans* ranges quite far southward along the eastern base of the Andes. I also refer to this form the same author's *M. griseogena* from Mexico, Honduras, Costa Rica, Panama, and Santa Fé de Bogotá.

GEOGRAPHICAL DISTRIBUTION.—*Sciurus æstuans*, including its two varie-

\* Buffon's description of *Le Petit Guerlinguet* would lead one to suppose it to have been based on an adult individual. He says . . . "les testicules de ce petit guerlinguet étoient beaucoup plus gros que ceux du grand guerlinguet, à proportion du corps, quoique ces parties présentent dans le grand guerlinguet de la même grosseur que dans nos écureuils."—(*Hist. Nat. Suppl.* tom. vii, p. 304.) It seems certain that a species of Squirrel so remarkable as this could not so long remain unknown in a region whose zoölogy is now so well known as that of Cayenne and Eastern Brazil.

ties, ranges from Southern Brazil northward to Costa Rica, and from the Atlantic coast westward to the eastern base of the great Andean chain. Var. *æstuans* ranges throughout Brazil, extending westward to Eastern Bolivia and northward to Guiana, but it seems to be nowhere common. Var. *rufoniger* extends over the northern states of South America, including Venezuela, New Granada, and probably portions of Ecuador, and thence southward to Eastern Peru. In Costa Rica, it seems to be one of the most abundant of the *Sciuri*.

TABLE LII.—Measurements of eighteen specimens of *SCIURUS ÆSTUANS* var. *ÆSTUANS*.

Catalogue-number.	Locality.	Sex.	From tip of nose to—				Tail to end of—		Length of—		Height of ear.	Nature of specimen.
			Eye.	Ear.	Occiput.	Tail.	Vertebra.	Hairs.	Fore foot.	Hind foot.		
4000	Canta Gallo, Brazil .....	♂	0.97	1.70	2.12	7.75	7.00	9.00	1.93	1.90	0.60	Alcoholic.
4002	do .....	♂	0.95	1.77	2.10	7.65	7.25	10.55	1.92	1.88	0.58	do.
4001	do .....	♂	0.96	1.60	1.95	6.80	6.80	9.15	1.23	1.23	0.60	do.
4030	do .....	♂	0.95	1.70	2.15	7.50	7.25	9.00	1.23	1.10	0.64	do.
4003	do .....	♂	0.73	1.35	1.50	5.50	5.25	6.75	1.10	1.00	0.59	do.
3850	Rio de Janeiro, Brazil .....	♂	0.78	1.35	1.72	5.85	6.45	8.20	1.95	1.85	0.67	do.
4102	San Matheos, Brazil .....	♂	0.95	1.70	2.12	7.80	7.50	.....	1.95	1.93	0.70	do.
3900	Rio de Janeiro, Brazil .....	♂	0.90	1.85	2.23	7.60	7.50	9.00	1.37	2.05	0.68	do.
3933	Obydos, Brazil .....	♂	0.87	1.80	2.00	7.05	.....	.....	1.15	1.80	0.57	do.
1446	Rio de Janeiro .....	♂	0.80	1.67	2.00	7.30	6.75	9.10	1.50	1.75	0.63	do.
1947	do .....	♂	1.03	1.63	2.15	7.75	7.00	8.75	1.15	1.95	0.60	do.
1956	do .....	♂	0.83	1.60	1.85	6.30	5.75	8.05	1.17	1.90	0.57	do.
4235	Brazil .....	♂	0.92	1.53	2.00	7.05	7.00	.....	1.35	2.03	0.70	do.
4236	do .....	♂	0.98	1.77	2.05	8.10	7.50	.....	1.54	2.00	0.67	do.
4237	do .....	♂	0.87	1.68	2.07	7.00	6.80	.....	1.35	1.98	0.65	do.
4238	do .....	♂	0.80	1.50	1.93	6.50	7.80	.....	1.30	2.10	0.73	do.
1833	Santa Rita, Brazil .....	♂	0.98	1.50	1.98	7.50	7.90	8.90	1.85	1.85	.....	Skin.
*9048	Brazil .....	♂	0.90	1.70	1.95	8.20	7.85	9.50	1.87	1.90	.....	do.

\* In National Museum, Washington, D. C.; all the others in Museum of Comparative Zoology, Cambridge, Mass.

TABLE LIII.—Measurements of sixteen specimens of *SCIURUS AESTUANS* var. *RUFONIGER*.

Catalogue-number.	Original number.	Locality.	Sex.	From tip of nose to—				Tail to end of—		Length of—		Height of ear.	Nature of specimen.
				Eye.	Ear.	Occiput.	Tail.	Vertebrae.	Hairs.	Fore foot.	Hind foot.		
19043	33	Costa Rica.....	♂	1.00	1.90	2.90	9.25	7.75	9.75	1.35	2.05	.....	Skin.
19053	.....	do.....	♂	0.95	1.88	2.18	10.00	.....	.....	.....	2.05	0.56	do.
19053	98	do.....	♂	0.93	1.87	2.10	9.00	.....	.....	.....	2.10	0.43	do.
19058	.....	do.....	.....	.....	.....	.....	7.50	6.25	8.00	1.17	2.00	.....	do.
19056	.....	do.....	.....	1.05	1.90	2.15	8.25	.....	.....	.....	1.10	1.90	do.
19060	86	do.....	♂	0.99	1.80	2.07	8.75	.....	.....	.....	2.05	.....	do.
19057	85	do.....	♂	1.00	1.80	2.18	8.75	.....	.....	.....	2.00	0.57	do.
19050	34	do.....	.....	.....	.....	.....	8.25	5.75	7.00	1.25	1.95	0.50	do.
19050	.....	do.....	♀	0.97	1.83	2.15	8.75	6.00	8.00	1.25	1.85	.....	do.
19051	80	do.....	♂	0.85	1.83	2.03	6.50	8.25	.....	1.30	2.00	.....	do.
9307	.....	do.....	♂	1.00	1.85	2.15	8.75	7.00	8.35	1.30	2.05	.....	do.
11363	.....	do.....	♂	1.03	1.85	2.17	.....	.....	.....	1.25	2.00	.....	do.
11379	15	do.....	♂	0.97	1.85	.....	8.90	7.00	8.90	1.25	2.03	.....	do.
11389	16	do.....	♂	0.85	1.70	.....	8.00	6.75	8.25	1.20	2.00	.....	do.
11700	.....	do.....	.....	0.95	1.89	2.20	8.50	7.50	8.00	1.35	2.07	.....	do.
11733	.....	Venezuela.....	♀	.....	.....	.....	8.50	6.75	8.60	1.15	1.90	.....	do.
.....	.....	do.....	♀	0.80	1.65	.....	8.75	7.50	8.00	1.10	1.78	.....	do.

TABLE LIV.—List of specimens examined of *SCIURUS AESTUANS* var. *AESTUANS*.

Catalogue-number.	Sex and age.	Locality.	From whom received.	Collected by—	Nature of specimen.
1833	♂	Santa Rita, Brazil.....	Thayer Expedition.....	Geo. Seova.....	Skin.
4060	♂	do.....	.....	.....	Alcohol.
4061	♂	do.....	.....	.....	do.
4062	♀	do.....	.....	.....	do.
4059	♂	do.....	.....	.....	do.
4063	♂	do.....	.....	.....	do.
4109	♀	San Mateos, Brazil.....	.....	Harti and Copeland.....	do.
3960	♀	Rio de Janeiro, Brazil.....	.....	J. A. Allen.....	do.
1946	♂	do.....	.....	.....	do.
1347	♀	do.....	.....	Thayer Expedition.....	do.
1945	.....	do.....	.....	.....	do.
1940	.....	do.....	.....	.....	do.
1850	♂	do.....	.....	.....	do.
3933	♂	Ohydos, Brazil.....	.....	N. Dexter.....	do.
4235	♀	Brazil.....	.....	D. Bourget.....	do.
4236	♀	do.....	.....	.....	do.
4237	♀	do.....	.....	.....	do.
4238	♂	do.....	.....	.....	do.
9046	.....	do.....	F. d'Albuquerque.....	F. d'Albuquerque.....	Skin.

\* In National Museum, Washington, D. C.; all the others in Museum of Comparative Zoology, Cambridge, Mass.

TABLE LV.—List of specimens examined of *SCIURUS ÆSTUANS* var. *RUFONIGER*.

Catalogue-number of skin.	Original number.	Sex.	Locality.	From whom received.	Collected by—	Nature of specimen.
9397	...	...	San José, Costa Rica.....	Wm. M. Gabb.....	J. C. Zelandou.....	Skin.
11363	14	...	Costa Rica.....	do.....	do.....	do.
11363	91	...	do.....	do.....	do.....	do.
11366	17	♂	do.....	do.....	do.....	do.
11367	...	♂	do.....	do.....	do.....	do.
11369	16	♂	do.....	do.....	do.....	do.
11370	15	♂	do.....	do.....	do.....	do.
11700	...	♀	do.....	do.....	do.....	do.
11415	17	...	do.....	do.....	J. Carmiel.....	do.
11416	17	...	do.....	do.....	do.....	do.
12045	31	...	do.....	Talamanca Expedition.....	Wm. Gabb.....	do.
12050	34	...	do.....	do.....	do.....	do.
12051	89	...	do.....	do.....	do.....	do.
12053	46	...	do.....	do.....	do.....	do.
12053	96	...	do.....	do.....	do.....	do.
12055	...	♂	do.....	do.....	do.....	do.
12056	...	...	do.....	do.....	do.....	do.
12057	...	♀	do.....	do.....	do.....	do.
12058	...	...	do.....	do.....	do.....	do.
12059	...	♀	do.....	do.....	do.....	do.
12060	86	♂	do.....	do.....	do.....	do.
9325	...	...	Guayaquil.....	Dr. Destruge.....	Dr. Destruge.....	do.
11723	...	♀	Venezuela.....	Williams Coll. Lye. Nat. Hist.	do.....	do.
...	...	♀	do.....	do.....	do.....	do.
3399	...	♂ ♀	Truando River, New Granada....	Lieut. Michler.....	A. Schott.....	do.
3303	...	♂ ♀	do.....	do.....	do.....	do.

## SCIURUS TEPHROGASTER (Gray) Allen.

## Orizaba Squirrel.

† *Macrozue fraseri* GRAY, Ann. and Mag. Nat. Hist. 3d ser. xx, 1807, 430.

*Macrozue tephrogaster* GRAY, ib. 431; ib. 4th ser. x, 1872, 406.

*Macrozue taninus* GRAY, ib. 3d ser. xx, 1867, 431.

*Macrozue middellinensis* GRAY, ib. 4th ser. x, 1872, 406 (New Granada).

SPECIFIC CHARs.—Size of *Sciurus æstuans* var. *rufoniger*; length of body 8.75 (ranging from 8.50 to 9.25); of tail-vertebræ 7.00 to 7.50; of tail to end of hairs 9.00 to 9.60. Color above, dark olivaceous-brown, minutely varied with yellow or rufous, with the middle of the back darker than the sides, and with less rufous. Beneath, whitish-gray or fulvous, varying in different specimens from nearly pure white to orange, with the basal portion of the hairs dusky; generally grayish below, washed with reddish-fulvous. Tail above, black, washed with white; below, reddish-brown, ringed with black centrally, with a broad subterminal bar of black, succeeded by whitish tips. The small ear-patch varies from white to gray, fulvous, and even rufous.

This species, in size, proportions, and in the color of the dorsal surface, is almost inseparable from var. *rufoniger* of *S. astuans*; it is, however, readily distinguishable from that species by the generally almost wholly gray color of the ventral surface, over which the hairs are conspicuously dusky at the base, and by the *white* instead of red edging of the tail. It furthermore has two premolars, the first quite large for a *Sciurus*, while in the large number of specimens of both varieties of *S. astuans* I have examined I have found uniformly only one. It is so wholly distinct from all the other *Sciuri* as to require no detailed comparison with any of them.

The seven specimens of this species before me vary in respect to coloration as follows:—One (No. 7849, Orizaba, Mexico) is pure gray below throughout, the hairs being tipped with white and dusky at base; above, olivaceous-dusky, minutely punctulated with yellowish-rufous; middle of the back blackish; ear-patch whitish. No. 7206, also from Orizaba, is similar, except that the sides are rather more strongly varied with yellowish-rufous, and the pectoral region is distinctly washed with fulvous. No. 8491, from near Cordova, is almost exactly like the last, being perhaps rather more fulvous below and a little redder on the flanks. Another (of which the label is lost) is still more rufous above and more fulvous below. No. 8490 (Cordova) is like the last, with, however, distinctly white ear-patches. No. 3922 (Mexico) is more rufous above, and is washed strongly with reddish-fulvous below. No. 3261 (Mexico) is bright orange below, but above is wholly like the gray-bellied specimens from Orizaba. No. 8620, from Central Guatemala, is fulvous-washed below, but is strongly ferrugineous above, with reddish-yellow ear-patches, the prevailing color dorsally being ferrugineous, slightly varied with black. In this specimen, the hairs of the dorsal surface are double-ringed with fulvous, plumbeous at base, then a narrow ring of fulvous, followed by another of black, and tipped with rusty. In all the other specimens, the hairs are wholly blackish, except the tip, which is yellowish, varying more or less in different specimens to rufous.

Of the eight specimens of this species before me, seven are from Southern Mexico and the other from Guatemala. Dr. Gray refers to his *M. tephrogaster* specimens from "Mexico (Sallé), Guatemala (Salvin), Honduras (Dyson), and Bogota (H. E. Strickland)"; I also refer to the same species his *M. tenuis* from Guatemala, his *M. middellinensis* from Antioquia, New Granada, and less confidently his *M. fraseri* from Ecuador. The first three of these names I think are unquestionably referable to this species.



I have met with no description published earlier than 1867 that seems at all applicable to this species. So far as external characters are concerned, it might be regarded as a subspecies of *S. astuans*, the differences being far less than between either of the subspecies of *S. hudsonius*, and rather less, or certainly not greater, than obtain between *S. astuans astuans* and *S. astuans rufoniger*. It was only the discovery of the presence of two upper premolars (the first also large for a *Sciurus*) that led me to recognize it as specifically distinct from *S. astuans*. Five of the eight skins of *S. tephrogaster* contain the skulls, and in each are two upper premolars. On the other hand, in examining the dentition of some twenty or more specimens of *S. astuans*, embracing about an equal number of each variety, I have met with none having more than a single upper premolar.

The habitat of *S. tephrogaster* may be considered as embracing Southern Mexico and Central America, and as extending southward over the northern states of South America to Central New Granada, and probably to Ecuador.

TABLE LVI.—Measurements of seven specimens of SCIURUS TEPHROGASTER.

Catalogue number.	Original number.	Locality.	Sex.	From tip of nose to—				Tail to end of—		Length of—		Height of ear.
				Eyes.	Ear.	Occiput.	Tail.	Vertebra.	Hairs.	Fore foot.	Hind foot.	
3021	..	Mexico .....	♂	0.95	1.80	3.00	8.50	7.00	8.00	1.10	2.01	.....
3911	...	do .....	♀	0.97	1.75	.....	9.90	.....	1.35	2.05	.....	.....
7300	13	Orizaba, Mexico .....	♂	0.93	1.83	2.10	8.75	.....	1.23	1.95	0.7	.....
7849	1	do .....	♀	0.97	1.90	2.30	9.25	.....	1.40	2.05	0.00	.....
8430	..	Cordova, Mexico .....	♀	0.85	1.75	.....	9.00	7.25	9.03	1.30	1.93	0.62
8431	...	do .....	♂	0.87	1.65	.....	8.60	.....	1.25	2.00	0.00	.....
8830	...	Central Guatemala .....	♂	0.80	1.65	.....	8.50	7.50	9.00	1.30	1.80	.....

TABLE LVII.—List of specimens examined of SCIURUS TEPHROGASTER.

Catalogue number.	Original number.	Sex.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
8490	27	...	Potero, near Cordova, Mexico .....	April —, 1865	Prof. F. Samichrast	Prof. F. Samichrast	Skin.
8431	28	...	do .....	do .....	do .....	do .....	do .....
7300	13	♂	Orizaba, Mexico .....	do .....	do .....	do .....	do .....
7849	1	♀	do .....	Nov. 1, 1864	do .....	do .....	do .....
2861	...	♀	Mexico .....	do .....	Verreaux Brothers	do .....	do .....
3022	...	♂	do .....	do .....	H. de Sausseure	H. de Sausseure	do .....
...	...	...	do .....	do .....	do .....	do .....	do .....
8700	...	...	Central Guatemala .....	do .....	Henry Hague	Henry Hague	do .....



## SCIURUS GERRARDI Gray.

## Gerrard's Squirrel.

*Sciurus gerrardi* GRAY, Proc. Zool. Soc. Lond. 1861, 92, pl. xiv (New Granada).

*Macrozous gerrardi* GRAY, Ann. and Mag. Nat. Hist. 3d ser. xx, 1867, 430.

*Macrozous brunneo-niger* CASTELNAU, MS.—GRAY, Ann. and Mag. Nat. Hist. 3d ser. xx, 1867, 429 (Brasil).

*Macrozous xanthotus* GRAY, Ann. and Mag. Nat. Hist. 3d ser. xx, 1867, 429 (Costa Rica).

? *Macrozous ignitus* GRAY, Ann. and Mag. Nat. Hist. 3d ser. xx, 1867, 429 (Bolivia).

**SPECIFIC CHAR.**—Intermediate in size between *Sciurus variabilis* and *Sciurus aestuans* var. *rufoniger*. Length of body from end of nose to base of tail about 9.50; of tail-vertebrae about 8.00; of tail to end of hairs about 10.00 to 10.50; of hindfoot about 2.25. Top of the head and middle region of dorsal surface black or dusky; rest of dorsal surface varied with yellowish-rufous and black; below, deep reddish-brown or bright reddish-orange; outer side of the limbs sometimes like the ventral surface, sometimes like the dorsal surface; in some specimens, dark fiery red-brown, darker than the ventral surface. Tail rather full and bushy, the base of the hairs yellowish-brown, with narrow rings of black; a broad subterminal black bar, broadly tipped with reddish-golden, varying to dark fiery-red. Pelage short and sparse, especially below.

To this species I refer three badly prepared skins from Nercua, New Granada, and four specimens in alcohol from near Obispo, Panama, two of which are evidently not of adult size. The three Nercua specimens vary in color below from dark reddish-orange to dark reddish-brown. In two, the middle of the back is black, the rest of the dorsal surface being varied with yellowish-rufous and black, the former color prevailing. The hairs individually are dusky at the base, with a broad subterminal yellowish-rufous bar, and tipped with black. In one of the specimens, the black band along the middle of the back is narrow and not well defined. In one, the whole upper surface of the head, including the sides of the nose, is nearly as dark as the middle of the back; in the others, the head is varied with yellow and black. In one, the surface of the tail is reddish-golden; in another, red; and in the third, dark cherry-red. Of the Panama specimens, one (No. 3224, adult male) is deep red above, blackish on the occiput and rump, and pale red below, with the tail black at the base and tip, and the middle half red. Another (No. 3644, a young female) is dusky above, varied with reddish-yellow, and bright ferrugineous below, with the tail black, the middle half broadly edged with red. No. 3216 (also an immature female) is similar to the last, but is

rather darker above and less varied with yellow. The other (No. 3647, a breeding female) is more varied above with reddish-yellow than either of the others, and rather paler below. The tail, as in the others, is partly black and partly red.

This species has essentially the same style of coloration as *Sciurus variabilis*, but differs from it in its smaller size and much smaller ears. Like that species, it probably runs into phases in which the ventral surface is white. It differs from *Sciurus aestuans* in being much larger and in coloration, it much exceeding in size even its larger northern variety, and being much redder. The Nercua specimens, however, much resemble it in coloration.

Dr. Gray's description and figure of his *Macroxus gerrardi* from New Granada agree very well with the specimens above described, differing only in his *S. gerrardi* being white below. As, however, one of the Panama specimens is very pale below (nearly white), and the allied species all present white-bellied phases, I adopt the name *gerrardi* for this species. Gray's later description of his *M. xanthotus* from Veragua agrees well with the specimens from Nercua; and I also refer more doubtfully to this species his *M. bruno-niger* from Brazil and his *M. ignitus* from Bolivia, not feeling sure, however, that both the latter may not be referable to *S. aestuans* var. *rufo-niger*. Assuming, however, that these supposed species are referable to the species here called *S. gerrardi*, we should have the habitat of the latter extending from Costa Rica to Bolivia.

TABLE LVIII.—Measurements of seven specimens of SCIURUS GERRARDI.

Catalogue number.	Origin of number.	Locality.	Sex and age.	From tip of nose to—				Tail to end of—		Length of—		Height of ear.	Nature of specimen.
				Eye.	Ear.	Occiput.	Tail.	Vertebra.	Hairs.	Fore foot.	Hind foot.		
3306	324	Nercua, No. Granada.....	♀	.....	.....	.....	10.50	7.25	9.25	1.40	2.20	.....	Skin.
3301	.....	do .....	♂	.....	.....	.....	9.50	7.25	9.25	1.40	2.25	.....	do.
3300	325	do .....	♀	.....	.....	.....	9.75	.....	.....	1.50	2.40	.....	do.
*3684	.....	Isthmus of Darien.....	♂	1.03	2.03	2.45	9.75	8.00	10.25	1.55	2.25	0.05	Alcoholic.
*3347	.....	Obispo, Panama.....	♀	1.00	2.00	2.45	9.70	8.75	10.00	1.50	2.10	0.00	do.
*3816	.....	do .....	♂	1.00	1.95	2.32	8.45	8.00	9.75	1.40	2.00	0.00	do.
*3644	.....	do .....	♂	1.10	1.95	2.40	8.70	7.50	8.90	1.65	2.25	0.05	do.

\* In Museum of Comparative Zoology, Cambridge, Mass.

TABLE LIX.—List of specimens examined of *SCIURUS GERRARDI*.

Catalogue-number.	Original number.	Sex and age.	Locality.	From whom received.	Collected by—	Nature of specimen.
3300	223	♂	Nercua, New Granada.....	Lieutenant Michler.....	A. Schott.....	Skin.
3301	...	♂	do.....	do.....	do.....	do.
3302	224	♀	do.....	do.....	do.....	do.
3324	...	♂	Isthmus of Darien.....	Captain Selfridge.....	Dr. G. A. Mearns.....	Alcoholic.
3647	...	♀	Obispo, Panama.....	Hassler Expedition.....	Hassler Expedition.....	do.
3316	...	♂	do.....	do.....	do.....	do.
3644	...	♀	do.....	do.....	do.....	do.

\* In Museum of Comparative Zoology, Cambridge, Mass.

*SCIURUS VARIABILIS* Geoffroy.

## Peruvian Squirrel.

*Sciurus variabilis* I. GEOFFROY, Étud. Zool. (Güerin's Mag. de Zool.), 1832, i, pl. iv.—Tschudi, Fauna Peruana, 1844-46, 155, pl. x.—SCHINZ, Syn. Mam. ii, 1945, 20.

*Sciurus langsdorffi* BRANDT, Mém. Acad. des. Sci. de St. Pétersb. 6e sér. Math. Phys. et Nat. iii, 2d pt. 1835, 425, pl. xi.—WAGNER, Suppl. Schreber's Säuget. iii, 1843, 184; Abhand. d. K.-B. Akad. d. Wissensch. v, 1850, 273.—SCHINZ, Syn. Mam. ii, 1845, 16.—GIBBEL, Säuget. 1855, 653.

*Macrozous langsdorffi* GRAY, Ann. and Mag. Nat. Hist. 3d ser. xx, 1867, 428.

*Sciurus igniventris* NATTERER, MSS.—WAGNER, Wieg. Arch. f. Naturgesch. 1849, i, 360; Abhand. d. K.-B. Akad. d. Wissensch. v, 1850, 275.—SCHINZ, Synop. Mam. ii, 1845, 22 (from Wagner).—D'ORBIGNY & GÉRAIS, Voy. dans l'Amér. mérid. iv, 2d pt. 1847, 24 (Bolivia).—GIBBEL, Säuget. 1855, 654.

*Sciurus pyrrhonotus* NATTERER, MSS.—WAGNER, Wieg. Arch. f. Naturgesch. 1849, i, 360; Abhand. d. K.-B. Akad. d. Wissensch. v, 1850, 277.—SCHINZ, Synop. Mam. ii, 1845, 22 (from Wagner).

*Sciurus stramineus* EYDoux, Zool. Voy. Bonite, 1844, 37, pl. ix.—Tschudi, Fauna Peruana, 1844-46, 150.

*Sciurus tricolor* POEPPIG, MSS.—Tschudi, Fauna Peruana, 1844-46, 150, pl. xi.—WAGNER, Abhand. d. K.-B. Akad. d. Wissensch. v, 1850, 270.

*Macrozous fumigatus* GRAY, Ann. and Mag. Nat. Hist. 3d ser. xx, 1867, 428.

**SPECIFIC CHAR.**—Size large; length of body about 11.00; of tail-vertebrae 10.00; to end of hairs 13.25. Pelage short, harsh, sparse, the ventral surface very thinly haired. Ears long and narrow; tail very full and bushy. Above, more or less varied with black and fulvous or red; red often, but sometimes black, being the prevalent tint; beneath, abruptly paler, yellowish-white, varying from nearly white to rufous; top of the head often darker. Basal portion of the tail usually black, or black slightly mixed with fulvous or rufous; apical and middle portions generally washed with golden or rufous, the tail being often wholly of this tint toward the tip. The hairs are generally fulvous at the extreme base, with the greater part of their length black, and tipped with golden or red, the black extending basally on the apical portion of the tail, but narrowing in extent till it is wholly concealed by the

golden or red extremities. The hairs of the dorsal surface are black at the base, broadly tipped with fulvous, rufous, or bright red, the posterior half of the dorsal surface of the body generally much redder than the anterior half. Runs occasionally into melanistic phases, in which the whole animal is black.

This species is most obviously distinguished among the South American *Sciuri* by its large size and very long, narrow ears, generally nearly or quite an inch in length, or even more. Its variability in color has given rise to numerous synonyms, often originating in the MS. names of collectors. It appears to vary in length of body from about 10.00 to 12.00 inches, the tail-vertebræ being about one inch shorter, and the tail with the hairs about two inches longer than the length of head and body.

This species was first described by Geoffroy, in 1832, as *Sciurus variabilis*, from Colombian specimens, in which the ventral surface was red. Brandt's *S. langsdorffi*, described from a Brazilian specimen in 1835, is evidently the same animal. Wagner,\* in 1843, pointed out the great variability in color to which he then supposed the *S. langsdorffi* of Brandt was subject, describing in detail four Brazilian specimens which varied greatly from each other in coloration. The ventral surface in one was light rust-yellow, in another white, in another rusty-brown, and in the other ferrugineous, darkening posteriorly to chestnut. The upper surface in the first was wholly fox-red, in the second black varied with brownish-yellow, passing into fox-red posteriorly, the third chiefly black above varied with yellow, the fourth mainly rufous. He failed, however, to identify Geoffroy's *S. variabilis* with this species. Tschudi redescribed and figured Geoffroy's *S. variabilis* from Peruvian specimens, in which the dorsal surface was light reddish-brown sprinkled with black, the ventral surface generally white, but sometimes red. Wagner, in 1842, published short diagnoses of *Sciurus igniventris* and *S. pyrrhonotus* Natterer, MS. These species he redescribed in detail in 1850, with fuller accounts also of *S. langsdorffi*, and a notice of the *S. tricolor* (Poeppig MS.) Tschudi. He refers to nine examples of *S. langsdorffi*, seven of *S. igniventris*, and nine also of *S. pyrrhonotus*, all, with one exception, from Natterer's collection. Under *S. langsdorffi*, Wagner states that the additional material received since the publication of his former notice of that species had led him to retract the opinions there expressed respecting the variability of *S. langsdorffi*, and that he considered as erroneous the reference

\* Suppl. Schreber's Nöget. III, 183.

to *S. langsdorffi* of three of the specimens there mentioned. He says furthermore that he believed the large Squirrels of Brazil were referable to several species,\* which he in this paper attempts to characterize. The differences he mentions, however, either in size or color, are by no means important, in view of the usual range of variation presented by the American *Sciuri*. He restricts, however, the *S. langsdorffi* to specimens strictly referable to Brandt's original description, or those having the dorsal surface varied with ochre-yellow and black, and the lower parts ochry-rust-yellow, with a small spot of white on the throat; the fore limbs pale yellow, sprinkled with black; the hind limbs similarly colored, but more reddish; the tail black at the base, mixed with pale yellow, passing toward the end into orange-red. The nine examples he refers to this species he says are all of the same color, and all come, according to Natterer, from Cuyaba, in the province of Matto Grosso, Brazil. According to his measurements, this species is the smallest of the four he here recognizes.

The seven specimens he refers to *S. igniventris* are all from Marabitanas, on the Upper Rio Negro. Four of them are red, the remaining three black. Two of the red specimens have the hairs of the back black, with light points, which in one are reddish-yellow, in the other grayish-yellow; so that in one the dorsal surface is rust-red sprinkled with black, in the other rust-yellow sprinkled with black. The under side of the body is beautiful rust-red. The tail is black at the base, but mostly red at the surface, with the hairs black basally, somewhat mixed with yellow. The size is given as a little larger than that of *S. langsdorffi*. This species he says differs from both *S. langsdorffi* and *S. pyrrhonotus* through its color and its habitat, and from the former also in size.

The nine specimens of *S. pyrrhonotus* were (except one) all collected by Natterer near the mouth of the Rio Madeira. The color above is lively rust-red, inclining anteriorly more to orange-red and posteriorly becoming fiery-red; below, whitish-yellow or ochre-yellow, lightest anteriorly. The tail is, as in the other species, black at the base, passing into rust-red or rust-yellow, with the hairs broadly black at the base. The eight specimens collected by Natterer are said to be all of the same color; the ninth, from Spix's

\* "Selbstem habe ich nun die ganze Sammlung von Natterer vergleichen können und bin dadurch mit ihm zur Ueberzeugung gelangt, dass nicht nur meine 3 vorhin genannten Exemplare gar nicht dem *Sciurus langsdorffi* angehören, sondern dass unter den grossen braunlichen Eichhörchen mehrere Arten zu unterscheiden seyen, wie ich dies nun aneinander setzen will."—(Abhandl. der math.-physik. Classe Bayer. Akad. der Wissenach. v. 374.)

collection, also similar, is the first of the four specimens previously referred by him to *S. langsdorffi*. My single specimen from Manaos (mouth of the Rio Negro) agrees most nearly with this species.

The *Sciurus tricolor*, first described by Tschudi, Wagner here discusses at some length, recognizing it as specifically distinct from the others. Descriptions of two specimens of this species are given from Tschudi, both from Northeastern Peru, and of two others collected by Spix, which he had previously referred to *S. langsdorffi*. One of Tschudi's specimens has the upper surface black, with each hair tipped with light ochre-yellow; the ventral surface soiled yellowish-white. The tail is black at the base, mixed with hairs ringed with brown or yellow-brown; the rest of the tail with the hairs broadly tipped with light fox-red. The other has the dorsal surface black, with the hairs broadly ringed with reddish-yellow (*mit breitem rothgelben Ringe*); the ventral surface, sides of the head, and whole inner surface of the limbs rust-yellow. As already stated, Wagner refers to this species two specimens mentioned in his first account of *S. langsdorffi* (the second and third). One of them is black above, sprinkled with brownish-yellow, passing on the hind limbs into rust-red; below, grayish-white. The other is similar, but the black more predominates over the yellow, and the under surface is rusty-brownish, and the tail is also somewhat darker.

The *S. stramineus*, described by Eydoux\* in 1844, from specimens taken in Northern Peru, is scarcely different from the so-called *S. igniventris*, and belongs to the same group. It has essentially the same size, the same large ears, and, judged by the description, the same coloration. The *Macrozous fumigatus* of Gray from the Upper Amazons is evidently based on a melanistic example, which is probably identical with the melanistic specimens from the Rio Negro referred by Wagner to his *S. igniventris*.

\* "Le corps de cet Ecureuil est couvert de poils assez courts, noirâtres, terminés de jaune paille doré. La teinte sur glais fauve est plus vive aux lombes et à la face externe des membres postérieurs. La queue a de long poils noirs terminés de jaune-blanchâtre, et elle paraît comme lavée de cette dernière couleur; elle est plutôt en panache que distique . . . . . Les joues et le menton sont de couleur fauve clair, et la face inférieure des membres, ainsi que le dessous du corps sont également pâles.

"Longueur du corps et de tête, 10 pouces (0.27). Longueur de la queue en comprenant ses poils terminaux, 11 pouces (0.30).

"Cet Ecureuil a été trouvé à Omatope au Pérou."—(*Voy. de la Bonite, Zool. 1, pp. 38, 39.*)

The plate shows large ears, but the color is quite unlike that given in the description, and better agrees with that of the *Sciurus robustus* of Geoffroy than with any of the above-described forms of *S. variabilis*.

The measurements of these species, as given by authors (mainly by Wagner), are as follows:—

Name.	Locality.	From tip of nose to base of tail.	Tail-vertebra.	Tail to end of hairs.	Ear.	Quoted from—
<i>Sciurus variabilis</i> .....	Eastern Peru .....	10.00	10.00	11.25	1.58	Tschudi.
<i>Sciurus langsdorffi</i> .....	Cuyaba, Matto Grosso, Brasil. ....	10.04	9.67	11.50	1.00	Wagner.
Do.....	Brasil.....	9.83	.....	12.00	1.03	Brandt.
<i>Sciurus igniventris</i> .....	Rio Negro, Brasil .....	11.75	.....	13.00	1.00	Wagner.
<i>Sciurus pyrrhonotus</i> .....	Mouth of Rio Macaira, Brasil. ....	11.25	10.16	13.16	1.00	.....do.
<i>Sciurus tricolor</i> .....	Northern Peru.....	12.34	11.00	13.50	1.00	.....do.
Do.....	do.....	12.17	.....	.....	.....	Tschudi.
<i>Sciurus stramineus</i> .....	Omatope, Peru .....	10.00	.....	11.00	.....	Eydoux.

My single specimen (a mounted example) from Manaus, Brazil, exceeds the largest of these measurements by nearly an inch (English scale), but agrees in coloration with Wagner's *S. pyrrhonotus*. As, however, the measurements given in the table are in the larger German inches, the difference is more apparent than real. The whole range of variation in size and color is not greater than usually occurs among the *Sciuri*, and is even far less than is often met with. There is the same style of coloration in all; the same short, thin, stiff pelage and long, pointed ears. The coloration of the lower parts in all is sharply separated from that of the upper surface of the body, reference to which is made by almost every author in describing these several supposed species. The lower surface varies only in the amount of rufous, being, in some specimens, only pale soiled or yellowish-white, in others bright rust, with numerous intermediate stages in others. The dorsal surface varies in respect to the greater or less prevalence of black or red, and in the tint of the red, which is sometimes yellowish-red, sometimes dark rust-red. The anterior half of the body is generally lighter than the posterior half, the color generally increasing in intensity posteriorly. All have the tail more or less red at the base, passing into yellowish-red or deeper red posteriorly.

According to Tschudi, only *S. "stramineus"* occurs west of the Andes, this species having been obtained by the naturalists of the "*Bonite*" at Omatope, in Northwestern Peru, near Payta. *S. variabilis* he gives as ranging chiefly in the upper forest region, east of the main Andean chain, and as not often occurring below 2,000 feet. Between 9° and 12° south latitude, it is



frequently to be met with.\* D'Orbigny and Gervais report the occurrence of *S. igniventris* from Chiquetos, Bolivia, and Wagner from the Rio Negro. The same author gives *L. langsdorffi* from Cuyaba, Matto Grosso, and *S. pyrrhonotus* from the mouth of the Rio Madeira. This would give a habitat extending from the eastern slope of the Andes to or below the mouth of the Rio Madeira, and from Southeastern Bolivia and Southern Matto Grosso northward to New Granada, nearly reaching the coast in Northwestern Peru.

### III.—Notice of doubtful species.

#### 1.—SCIURUS NEBOUXI Is. Geoffr.

*Sciurus neboxi* Is. GEOFFROY, Voy. de la Vénus, Zool. 1855, 165, pl. xii.

The specimen from which this species was described and figured is said to have been obtained by Dr. Nébox at Payta, Peru. It came doubtless not from the immediate vicinity of Payta, but from the neighboring forest-region of the interior. Geoffroy gives a colored figure of the animal, two-thirds the natural size, with two views of the skull (natural size), and a figure of the upper molar teeth, as seen from above. Geoffroy states that there is no trace of the small anterior upper premolar so often present among the true Squirrels.

According to Geoffroy, this specimen measured 10.60 (270<sup>mm</sup>) from the end of the nose to the base of the tail.

"La couleur générale du pelage est le gris. Cette couleur, plus ou moins modifiée, est en effet celle de l'animal entier, moins les oreilles, les moustaches et les quatre pattes qui sont noires, et une tache blanche, composée de poils beaucoup plus longs que les autres, et située sur le col, à peu de distance de la base des oreilles.

"Le gris est d'une nuance pure et qui rappelle la couleur du Capistrato [*Sciurus niger* var. *niger*], sur la plus grande partie du dos et sur la face externe des membres antérieurs; mais il passe au noir tiqueté sur la tête, et au fauve sur la partie postérieure du dos, la croupe et les faces extérieure et postérieure des membres, ainsi que sur la base de la queue. Dans la portion qui est d'un gris pur, les poils sont noirs avec leur extrémité [gris?]; dans la portion roussâtre, ils sont de même noirs, mais avec l'extrémité fauve.

\* "Zuerst erscheint dasselbe *Sc. variabilis* schon an der untern Gränze der Cajaregion bei 5000' ü. M.; in der obern Waldregion ist sein Hauptverbreitungsbezirk; wir haben ihn zwischen 9-12° S. B. sehr häufig getroffen. Es scheint, dass er tiefer als 2000' nicht mehr getroffen, sondern dasselbe durch *Sc. tricolor* und *Sc. asiaticus* vertreten wird. Ersteren fand Hr. Prof. Poeppig nur in den feuchten Urwäldern des tiefer gelegenen Theiles von Maynas, also ganz im nördöstlichen Peru. Sein weiterer Verbreitungsbezirk ist noch ganz unbekannt, doch hat er nach Süden vielleicht auch erst bei 14-16° S. B. seine Gränze."—(*Fauna Peruana, Therologia*, p. 160.)



"Les parties inférieures du corps et les parties internes des membres, ainsi que le tour de la bouche, sont d'un gris clair légèrement teinté de jaune. Les poils des côtés du ventre ont les deux mêmes couleurs que les poils du dos, mais sont beaucoup plus courts. Les poils plus courts qui couvrent le milieu du ventre et de la poitrine, présentent aussi les deux mêmes couleurs; mais avec cette différence que le blanc ou le fauve occupe la plus grande partie de leur étendus.

"La queue, ronde et non distique, est, sauf sa base dont la couleur a été plus haut indiquée, d'un gris blanchâtre, les poils étant noirs dans leur première portion, puis blanc vers leur extrémité. De plus, parmi eux, sont entremêlés quelques poils entièrement blancs."

In comparing this species with his *S. "aureogaster"* (= *leucops*, nec *aureogaster* F. Cav.), described and figured in the same work, he dwells particularly upon the differences in dentition that exist between them, not only in respect to the form of the teeth, but in respect to the presence in *S. nebouri* of only a single upper premolar instead of two.

This species, here given provisionally, seems quite different from any other hitherto described; it may, however, be merely a gray phase of some other well-known species, possibly of *Sciurus hypopyrrhus*.

## 2.—*SCIURUS DIMIDIATUS* Waterh.

*Sciurus dimidiatus* WATERHOUSE, Proc. Zool. Soc. 1840, 21.

*Macrozous dimidiatus* GRAY, Ann. and Mag. Nat. Hist. 3d ser. xx, 1867, 434.

This species, described originally by Waterhouse as probably South American, I am unable to identify with any American species. It is thus far known only from Waterhouse's original specimen from an unknown locality. As Dr. Gray has suggested, it is more likely of African origin. Mr. Waterhouse's description is as follows:—

"*Sciurus dimidiatus*. Sci. suprâ griseus fulvo lavatus, subtus flavus; capite, corpore ad latera pedibusque rufescentibus; caudâ ferè corporis longitudinem æquante, indutâ pilis nigris, flavis atque fulvis commixtis.

	unc.	lin.
"Longitudo ab apice rostri ad caudæ basin .....	10	0
"caudæ, ferè .....	7	6
"ab apice rostri ad basin auris .....	1	11
"tarsi digitorumque .....	2	3
"auris .....	0	8

"Hab. South America?"

"This curiously-colored species of Squirrel was purchased at a sale, and

in the same lot were specimens of *Sciurus astuans* and *Sc. iangsдорffi*, well-known South American species; it is probable, therefore, it may be an inhabitant of the same country. Its fur is very short for a Squirrel, rather harsh, and less loose than in the generality of Squirrels: the back is gray, or what might be termed an iron-gray, having a rusty hue; on the upper part of the head the rust-like tint prevails, and the muzzle is almost entirely of a rich rust color; the sides of the head and neck are of a golden-yellow tint, and the under parts of the body are yellow: a bright rust-colored line runs along each side of the body, and separates the yellow coloring of the under parts from the iron-gray of the upper; on the outer sides of the limbs, and on the feet, a rich deep golden-yellow hue prevails. The tail is apparently cylindrical, and not bushy; the prevailing hue of the hairs is deep rust color, but they are for the most part more or less broadly annulated with black in the middle. The ears are slightly pointed, and well clothed with golden-yellow hairs; those on the outer side are of a bright rust color; they have no pencil of hairs at the tip. The hairs of the moustaches are numerous, long, and of a black color. The incisors of both upper and under jaws are deep orange."

Gray's description of Waterhouse's original specimen is as follows:—"Fur rather harsh, abundant, reddish iron-gray; hairs short, close, black at the base, with a broad pale-brown ring, a dark-brown subterminal ring, and a white tip; upper part of head, shoulders, legs, thighs, and feet, and a streak along each side of the body rufous; sides of the head, chin, and beneath yellow; tail reddish, black-varied; hairs reddish-brown, with a broad black subterminal ring and reddish end, and gray base."

Dr. Gray adds,—“This specimen was purchased at a sale with some South American Squirrels; but it has much more the appearance of an African Squirrel. No other specimen of this Squirrel has occurred to me; so the true habitat is still doubtful.”

### 3.—SCIURUS BOTTEÆ Less.

*Sciurus botte* LESSON, Cent. Zool. 1833, 221, pl. lxxvi; “Desc. des Mamm. et Ois. 1847, 140.”—WAGNER Suppl. Schreber's Säuget. iii, 1843, 1843, 173 (from Lesson).—SCHINZ, Synop. Mamm. ii, 1846 10 (from Lesson). See also BAIRD, Mamm. N. Amer. 1867, 221.

The *Sciurus botte*, described by Lesson from a specimen said to have come from California, agrees well with nothing I have as yet met with, and is certainly in some respects unlike any animal at present known from either the California of to-day or the California of fifty years ago. It is evi-

dently a true *Sciurus*, and in many points recalls *S. hudsonius* var. *douglasi*, as in the proportional length of the tail to the body, the form and color of the ears, the color of the ventral surface, and somewhat in the color of the dorsal surface. It differs, however, in being larger, in the pelage being rather harsh, in the tail being rounded (though somewhat distichous), and somewhat in coloration. The length of the body, being ten inches, is fully an inch greater than in large specimens of var. *douglasi*. The hairs of the latter are not, however, colored, "par portions presque égales, de blanc, de brun, de blanc fauve et de roux", although the general tint of the dorsal surface—"d'un roux-fauve clair, varié de noir"—is occasionally not greatly different. If the locality is correctly indicated, it can, however, scarcely be anything else. According to Professor Baird, Dr. J. E. Gray believed it referable to *Spermophilus beecheyi*, but this, as suggested by Professor Baird, is highly improbable.

Lesson's description in full is as follows:—

"L'ÉCUREUIL DE BOTTA.

"*Sciurus botta* Less.

"Cet écureuil, rapporté de la Californie par le docteur Botta, nous a été communiqué par M. Florent Prévost. Il a de longueur totale seize pouces, et dans ces dimensions la tête entre pour deux pouces et la queue pour six pouces six lignes. Les membres antérieurs ont deux pouces et demi de hauteur, et les postérieurs trois et demi.

"Cette espèce a la queue arrondie, à poils médiocrement distiques, et sa forme est légèrement pointue à l'extrémité par l'amincissement successif, depuis la naissance des vertèbres coccygiennes jusqu'à leur terminaison.

"Les moustaches sont composées de poils fins, grêles, assez nombreux et noirs. Les oreilles sont pointues, garnies en dedans de poils très-courts, qui s'allongent au sommet en un petit pinceau grêle et mince. Tous les doigts sont revêtus jusqu'aux ongles, en dessus et sur les côtés, de poils ras et serrés. Le dedans des mains et des pieds est nu, à partir des surfaces palmaires et plantaires. Le pouce de la main est complètement rudimentaire; celui du pied est assez robuste, bien que plus court que le doigt externe. Les trois doigts moyens sont au pied à peu près de même longueur.

"Le pelage de cet écureuil est partout médiocre, serré, assez dense et peu rude. Les poils s'allongent sur les lombes et sur les fesses, et principalement sur la queue. Chaque poil est coloré, par portions presque égales, de

blanc, de brun, de blanc fauve et de roux. Il en résulte une teinte générale fauve, ondée de roux et surtout de noir sur toutes les parties supérieures et externes. Le dessous du corps, au contraire, est en entier, à partir du menton jusqu'à l'anus, d'un fauve clair, tirant au blanchâtre. Ainsi le sommet de la tête paraît roux, les joues et les côtés du cou sont gris, le milieu du dos et les flancs, le haut des membres en dehors, sont d'un roux-fauve clair, varié de noir. La queue est de la nuance fauve et brune, chaque poil se trouvant terminé de fauve très-clair. Les pieds et les mains en dessus sont fauve clair. Les ongles sont cornés, petits, peu robustes et assez aigus. Les parties nues sont couleur de chair.

"Les oreilles de cet écureuil sont remarquables en dessus par le noir qui les colore, et qui s'affaiblit sur le bord postérieur, en prenant de l'intensité au sommet.

"L'écureuil de Botta rappellera les voyages d'un jeune médecin qui a enrichi les sciences naturelles et provient de la Californie, contrée neuve et curieuse, encore très-mal connue. On ignore quelles sont ses habitudes."—(*Centurie zoologique*, par R. P. LESSON, Paris, 1832, pp. 221, 222.)

#### 4.—SCIURUS CLARKI Ham.-Smith.

*Sciurus clarkii* HAMILTON-SMITH, Griffith's *Cuvier's An. King.* III, 1837, 189 (with a plate); lb. v, 1837.  
*Sciurus clarkii* and *Spermophilus clarkii* of numerous compilers; see also BAIRD, *Mam. N. Amer.* 1857, 379.

This species, figured by Major Hamilton-Smith from a specimen in the old Peale's Museum of Philadelphia, said to have been "brought there by the American Missouri travellers, Messrs. Lewis and Clarke", agrees strictly with no known American species of *Sciurus*. No indication is given of the size of the animal, but, judging by the colored figure, the proportions recall more strongly *Sciurus carolinensis* than any other North American Squirrel. Professor Baird thought it reasonable to suppose that there "is some error in the locality given, since Lewis and Clarke make no mention of such an animal in their very full notices of the zoölogy of the regions explored by them". He adds,—“This animal has, by some, been referred to as a *Spermophile*, but with no definite reason. I know of no permanent variety of Squirrel resembling this description at all. It has much the characters, in part, of an albino. At any rate, there is little doubt that no such animal inhabits western North America as a distinct and true species.”\* The “slight ochery tint” of the belly, it seems to me, is the only discrepancy of importance between the described characters of “*Sciurus clarkii*” and the light whitish-gray phase of

\* *Mam. N. Amer.* pp. 379, 380.

*Sciurus carolinensis*. If the specimen came really from North America, it is far more likely referable to this species than to any other.

Hamilton-Smith's description in full is as follows:—"Clarke's Squirrel has the back, upper part of the head and neck, cheeks and tail, of a delicate silver-gray colour; the shoulders, flanks, belly, and posterior extremities, both within and without, are white, with a slight ochery tint; on the sides of the nose and fore arms this tint deepens in intensity; the head is rather flattened and thick, the ears small and round; the eyes black, and situate on the sides of the head very far distant from each other, leaving a wide expanse of forehead; the nostrils are semilunar in shape; the upper lip is cleft, and there is a black spot on the chin; the tail, which is flat and spreading, is very beautiful, not so full near its insertion as toward the middle, and again diminishing in breadth till it terminates in a point."—(*Griffith's Cuvier's Animal Kingdom*, vol. iii, pp. 189, 190.)

#### 5.—*SCIURUS SOCIALIS* Wagner.

*Sciurus socialis* WAGNER, Abh. der math.-phys. Klasse der K. Bayer. Akad. d. Wissensch. II, 1837, 504, pl. v; Suppl. Schreber's Säuget. III, 1843, 171.

In 1837, Wagner described two species of Mexican Squirrels under the names *S. albipes* (subsequently changed to *S. varius*) and *S. socialis*, neither of which I can satisfactorily determine. The first I have doubtfully referred to *Sciurus boothiae* (see *antea*, p. 741), to some phases of which it seems to have a close resemblance. The *S. socialis*, in its small size (length 8.50) and short tail (somewhat shorter than the head and body), differs from anything as yet known to me. It is perhaps based on an immature specimen, in which case its small size would be readily accounted for. I have met with no description of a species of this size from Mexico or Central America, except *S. tephrogaster* and *S. astuans* var. *rufoniger*, from which it differs widely in coloration. Its short tail and small size suggest *Sciurus carolinensis*, but its rusty-yellow lower surface and tail rusty-red below, bordered with black and edged with white, render its proper reference here wholly improbable. Possibly it may have been described from an immature example of *S. aureigaster* (F. Cuv. = *S. ferruginiventris* Aud. and Bach.), to which I have been strongly inclined to refer it. Its short tail is here the chief point of discrepancy.

Wagner's later description is as follows:—

"*Sc. SOCIALIS* Wagn. *Das gesellige Eichhorn*.

"*Sc. supra ex albo, cinereo et flavescente mixtus, subtus pallide flavus, auriculus fulvis, pedibus albidis, vellere molli*" . . .

"Von mir nach einem Exemplare, das Herr von Karwinski aus Mexiko mitbrachte, aufgestellt. Kleiner als *Sc. varius*, der Pelz ungleich feiner, weicher und milder als bei diesem, sonst ihm in Form und zum Theil in der Färbung ähnlich. Die Haare sind ebenfalls meistentheils aus drei Farben geringelt, nämlich hell ockergelb, schwärzlich und weiss, wodurch eine gesprenkelte Zeichnung entsteht, und zwar in der Weise, dass auf der Schnautze die schwarz und lichtgelbe Farbe erscheint, welche letztere auf dem Hinterkopf, Nacken und Ohren lebhaft rostgelb wird und über das Schwarz vorherrscht. Auf dem Rücken hat die weisse und schwarze Sprenkelung die Oberhand, zwischen der hie und da das Lichtgelb durchschimmert, das auf dem Kreuz und der Schwanzwurzel stärker hervortritt. Auf dem übrigen Schweifrücken erscheint fast blos die schwarze und weisse Farbe, während auf der Unterseite das Rostroth zum Vorschein kommt, das beiderseits schwarz und dann weiss eingefasst ist. Am Hintergrunde der Ohren steht ein Büschel schneeweisser Haare; die Augen sind von einem hellern Ringe umgeben; die Schneidezähne licht gelblich angeflogen, die untern und seitlichen Theile des Kopfes weisslich, die Schnurren schwarz. Der ganze Unterleib licht und zart rostgelb, ebenso die Innenseite der Gliedmassen, während ihre Aussenseite weiss und aschgrau gesprenkelt ist; die 4 Pfoten sind oben ganz weisslich, die Krallen dunkel hornfarben.—Länge 8½", des Schwanzes etwas weniger. Die Heimath des Thieres sind, nach Herrn von Karwinski, die heissen Striche von Tehuantepec an der Südseeküste im Staate von Oaxaca, wo es in grossen Truppen gesellig sich zusammenhält und nicht aus der *Tierra caliente* ins Gebirg übergeht."—(*Suppl. Schreber's Säuget.* iii, pp. 170, 171.)

### GENUS TAMIAS III.

*Sciurus*, in part, of most early authors.

*Tamias* ILLIGER, *Syst. Mam. et Avium*, 1811, 86 (type "*Sciurus striatus* Lin.")

*Tamias* RAVENESQUE, *Amer. Month. Mag.* i, 1817, 308.

GENERIC CHARs.—Skull narrowed anteriorly; postorbital processes long, very slender, directed downward and backward; plane of malar bone more oblique and the zygomatic process of the maxillary more expanded and depressed than in *Sciurus*, but rather less so than in *Spermophilus*; anteorbital foramen oval, situated in the base of the zygomatic process of the maxillary; upper premolars two or one; when two are present, the first is generally minute; ears of medium size or small, well clothed, but never tufted; cheek-pouches large; pollex with a well-developed nail; tail shorter than the body, flattened and rather broad, shorter and much narrower than

in *Sciurus*; pelage generally full and soft; dorsal surface generally with two (sometimes four) longitudinal whitish stripes, bordered on each side with a stripe of black, and with (except in one species) a central dorsal stripe of black.

As already stated (*antea*, p. 639), *Tamias* bears a strong resemblance to some of the smaller species of *Spermophilus*, the two groups being in fact not sharply separable. The more important differences are the following:— In *Tamias*, there is sometimes but a single upper premolar, and when two are present the first is very minute, scarcely larger than in *Sciurus hudsonius*; in *Spermophilus*, two are always present, and the first is functionally developed, being from one-fourth to one-half the size of the second. In *Tamias*, the whole dentition is weaker and the teeth relatively smaller; the ante-orbital foramen is oval (sometimes quite narrow), and the outer and lower border is not generally developed into a projecting bony rim, culminating in a tubercle, as in *Spermophilus*. The notch in the posterior border of the zygomatic maxillary process is situated more anteriorly than in *Spermophilus*. The skull is much more delicate and papery than in *Spermophilus* of corresponding size, and shows no traces of the muscular ridges often seen in old skulls in the genus *Spermophilus*. The tail is usually also more flattened, and the general form of the animal is more Sciurine.

*Tamias* differs from *Sciurus* in the form and position of the ante-orbital foramen; in the greater obliquity of the plane of the zygoma and its more gentle downward deflection; in the more regularly oval, flattened, and depressed form of the skull, and especially in the skull being more narrowed anteriorly and in the nasal portion being more produced; in the molar series being divergent anteriorly instead of parallel; in the form of the lower jaw, which is slenderer, with the coronoid process longer, narrower, and more curved; in the possession of capacious cheek-pouches, and shorter and narrower tail.

As above diagnosed, *Tamias* includes two species referred by Professor Baird to *Spermophilus*, and hence members of the two commonly recognized "subfamilies" of the *Sciuridae*! These species are *Spermophilus harrisi* and *Spermophilus lateralis*. The latter makes a considerably nearer approach to the *Spermophiles* than does the former, but in all essential features they both much more nearly agree with the species usually referred to *Tamias* than with any of the *Spermophiles*. In respect to the skull, *T. harrisi* scarcely differs in any feature from *T. asiaticus* (= *quadrivittatus* et *pallasi* auct.) var. *townsendi*, and could scarcely with certainty be distinguished from it except that the skull of *T. harrisi* is rather the larger. The first premolar is as



small as it is in *T. asiaticus*, and is sometimes wholly wanting, as in skull No. 4239, from Cape Saint Lucas. In *T. lateralis*, the first of the two upper premolars is as large as in some of the *Spermophili*, the dentition is heavier than in the other *Tamias*, and in other cranial features this species is about as well referable to the one group as to the other. *T. asiaticus* has, as already intimated, two upper premolars, but the first is very small and slender. *T. striatus* has but a single upper premolar, and the muzzle is narrower and more pointed than in either of the other species.

The coloration of *T. lateralis* is quite similar in pattern to that of *T. striatus* and *T. asiaticus*, namely, an alternation of dark and light longitudinal stripes on the dorsal surface. *T. harrisi*, however, has only the white stripes. In respect to pattern of coloration, we have the following transition from *T. harrisi* to *T. asiaticus*:—*T. harrisi* has simply a single longitudinal white stripe on each side of the median line of the back; *T. lateralis* has the same stripes in the same position, but they are bordered on each side by a stripe of black, that on the outer side being usually much the broader; *T. striatus* has the two white stripes, bordered on each side by a broad line of black, the outer of which is the wider, with, in addition, a narrow median line of black. There are thus five black stripes and two white ones, the spaces between the inner black lines being gray. In *T. asiaticus*, these spaces are white or whitish, thus making in this species four white stripes, instead of two, which alternate with black ones of about the same width. The number of stripes thus increases from simply two white ones in *T. harrisi* to four white ones and five black ones in *T. asiaticus*. None of the true *Spermophili* are thus marked, although some have interrupted lines of white, as *S. tridecemlineatus* and *S. mexicanus*. In all the species of *Tamias*, the general color of the dorsal surface is gray, with the sides and sometimes the rump washed with rufous.

In both *T. harrisi* and *T. lateralis*, the tail is much shorter than in the other forms of *Tamias*, while *T. harrisi* differs from all the others in its much smaller ears. Externally, however, there is not only a general similarity in the pattern of coloration, but also in general form, while in cranial characters there is also a strong degree of similarity, these species agreeing in certain common cranial features, by which they are distinguished from the restricted *Spermophili*.\*

\* *Tamias lateralis* is, however, almost an exception, its cranial characters perhaps rather better agreeing with one of the sections of *Spermophilus* than with *Tamias*.



SYNOPSIS OF THE SPECIES AND VARIETIES OF *TAMIAS*.I. Premolars  $\frac{1}{1}$ :

1. Dorsal surface with two white stripes and five black ones; rump rufous; tail (with the hairs) three-fourths of the length of the head and body.....*STRIATUS*.

II. Premolars  $\frac{2}{2}$ :

2. Dorsal surface with four white (or grayish-white) stripes and five black ones; rump grayish; tail (with the hairs) equal to the head and body.....*ASIATICUS*.  
 a. Sides of body fulvous; dorsal stripes distinct, the white ones more or less mixed with grayish, the dark ones black.....*var. borealis*.  
 b. Sides of body bright rusty or golden; white of the dorsal stripes purer; the dark stripes strong, varying from dark chestnut to black.....*var. quadrivittatus*.  
 c. Merely a faint wash of fulvous on the sides of the body; the dark stripes of the dorsal surface very pale chestnut or dark brown rather than black; rump and nape pale whitish-gray; size small.....*var. pallidus*.  
 d. Colors everywhere pale; the dorsal stripes obsolete, or nearly so, the medial only being very prominent.....*var. dorsalis*.  
 e. General color above dull yellowish-brown; the light stripes scarcely lighter than the general color of the dorsal surface; the dark stripes black and strong; size large.....*var. townsendi*.  
 3. Above gray, with two broad stripes of white; sides reddish-gray; tail (with the hairs) rather more than half the length of the head and body, with the central portion white beneath; ears small.....*HARRISI*.  
 4. Above gray, with two white stripes, each bordered on both sides with black, the outer black stripe much broader than the inner; tail (with the hairs) about one-half the length of the head and body.....*LATERALIS*.

*Tamias* as above defined includes four species, one of which runs into several localized races, or subspecies. All are represented in North America; three of the species (*T. striatus*, *T. harrisi*, and *T. lateralis*) are not found elsewhere, while the fourth (*T. asiaticus*), in some of its forms, ranges over not only the western half of North America, but over a large portion of Northern Asia and Eastern Europe.

*TAMIAS STRIATUS* (Linn.) Baird.

## Striped Squirrel; Common Chipmunk.

- Sciurus striatus* CATESBY, Carol. II, 1731, 76, pl. LXXV.—LINNÆUS, Mus. Adolph. Frid. Regia, I, 1754, 8 (based wholly on an American specimen; cites only Catesby and Edwards); Syst. Nat. I, 1758, 64 (same as the preceding); ib. 1766, 87 (almost wholly, but includes reference to the Siberian animal).—SCHNEIDER, Säuget. IV, 1791, 791 (in part; "B. *Fus americanus*" and its synonyms only).—ERZLEBEN, Syst. Reg. Anim. 1777, 436 (refers almost exclusively to the American "Ground" Squirrel of the Eastern United States).—DESMAREST, Mam. 1822, 339 (in part).—HARRIS, Faun. Amer. 1825, 183 (in part).—GODMAN, II, 1826, 142.—EDMONDS, Quad. Mass. 1844, 24.—THOMPSON, Hist. Vermont, 1842, 46.—DE KAY, New York Zool. I, 1842, 62, pl. XVI, 2.  
*Myoxus striatus* BODDERT, Elenchus Animal. I, 1784, 122.  
*Sciurus striatus*, *β americanus* GMELIN, Syst. Nat. I, 1788, 150.—FISCHER, Synop. Mam. 1829, 348.  
*Tamias americana* KUHL, Beiträge zur Zoologie, 1830, 69.—GRAY, Ann. and Mag. Nat. Hist. 3d ser. II, 1867, 436 (= *T. striatus* Baird).  
*Sciurus americanus* FISCHER, Synop. 1829, 349 (= *T. americana* Kuhl).  
*Tamias striatus* BAIRD, 11th Ann. Rep. Smiths. Inst. 1857, 55, foot-note; Mam. N. Amer. 1857, 399, pl. XLV, fig. 2.—KENNICOTT, Rep. U. S. Pat. Off. Agric. for 1856 (1857), 70, pl. VIII.—THOMAS, Trans. Ill. State Agr. Soc. IV, 1860, 657.—GILPIN, Trans. Nova Scotia Inst. Nat. Sci. II, pt. 3, 1870, 16 (Nova Scotia).—ALLEN, Bull. Mus. Comp. Zool. I, 1869, 225; Proc. Bos. Soc. Nat. Hist. XVI, 1874, 189.

- Sciurus (Tamias) striatus* HALL, Canad. Nat. and Geol. 1861, 290.—ADAMS, Field and Forest Rambles, 1873, 100 (New Brunswick).  
*Sciurus carolinensis* BRISSON, Quod. 1766, 176.  
*Sciurus (Tamias) lysteri* RICHARDSON, Faun. Bor.-Amer. i, 1829, 181, pl. xv.—DOUGHTY's Cab. Nat. Hist. i, 1850, 169, pl. xv.  
*Tamias lysteri* WAGNER, Suppl. Schreber's Säuget. iii, 1843, 232, pls. ccxiv, ccxix.—SCHINZ, Synop. Mam. ii, 1846, 47.—AUDUBON & BACHMAN, Quod. N. Amer. i, 1849, 66, pl. viii.—GIEBEL, Säuget. 1865, 639.—MAXIMILIAN, Archiv f. Naturgesch. 1861, 79.  
*Ground Squirrel*, LAWSON, Nat. Hist. Carol. 1718, 124.—BRICKELL, North Carol. 1737, 129.—CATESBY, Carol. ii, 1743, 75, pl. lxxiv.—EDWARDS, Birds, iii, 1751, 181, pl. cxxxii.—PENNANT, Synop. Quad. 1771, 288 (in part).—KALM, Travels (Forster's transl.), i, 1770, 329, pl. i.  
*Ecouenil Suisse*, BAGARD-THÉODAT, Hist. du Canada, 1636, v, 746.—DENYS, Descrip. de l'Amér. Sept. ii, 1672, 331.—LA HONTAN, Voy. dans l'Amér. ii, 1709, 43.  
*Le Suisse*, CHARLEVOIX, Journ. d'un Voy. dans l'Amér. Sept. v, 1744, 198.—DU PRATZ, Hist. Louis. ii, 1758, 98.—BUFFON, Hist. Nat. x, 1763, 128, pl. xxviii.  
*Erdichhorn* and *Küschelstier*, KALM, Reisen (German edit.), ii, 1767, 462.  
*American Ground Squirrel*, GILPIN, Trans. Nova Scotia Inst. Nat. Sci. ii, pt. 3, 1870, 15.  
*Striped Squirrel*, *Chipping Squirrel*, *Ground Squirrel*, *Chipmunk*, *Le Suisse*, *Hackee*, *Vulgo*.

**SPECIFIC CHARs.**—Length (head and body) 5.75; tail to end of vertebrae 3.65; to end of hairs 4.25. Middle of the dorsal region gray, passing into rufous posteriorly, with five longitudinal narrow stripes of black, the two outer on either side separated by a line of white; sides washed with yellowish; head above brownish; whole lower surface of the body white; tail blackish above, edged with white, centrally below yellowish-rufous, bordered with black and edged with white. A light superciliary line extends from the nose nearly to the ear, which immediately above the eye is nearly pure white; a less distinct light line below the eye, which on the lower eyelid is nearly white; below this a faint stripe of reddish-brown, and another somewhat darker behind the eye. Nose whitish; feet like the sides of the body.

The color varies somewhat in different specimens from the same locality, especially in respect to the brightness of the yellowish wash on the sides of the body, and of the rufous of the posterior portion of the back, and also in the color and size of the dorsal stripes. The light stripes are generally yellowish- or creamy-white, but are sometimes nearly pure white. The black stripes are generally distinctly bordered with dark rufous or chestnut, and vary in respect to width and longitudinal extension. The middle one begins at the occiput as a narrow, often indistinct line of dark rufous, generally mixed more or less with black. At the shoulders, it expands, and passes thence posteriorly as a narrow black stripe bordered with rufous to within a short distance of the base of the tail. The two lateral black stripes are rather broader, but much shorter than the middle one, extending only from the posterior edge of the shoulder to the hip. The outer on either side is

rather broader and shorter than the inner. The inner is narrowly edged on the inner side with chestnut, as is the outer on the outer side. They are separated by a rather broad stripe of yellowish-white, which extends rather further both anteriorly and posteriorly than its enclosing stripes of black. The light stripes begin at a point directly above the shoulder, and are often faintly traceable to within half an inch of the base of the tail. The space between the dorsal line and the first lateral line on either side is gray, as is the region over the shoulders. The top of the head is more brownish; the sides of the head, neck, and body are yellowish, brightest on the sides of the neck. The extreme basal portion of the tail and the posterior fifth of the dorsal region and sides are dark reddish-brown or chestnut, generally with no indication of stripes. The hairs of the tail above are yellowish-white at the base, with a broad subterminal bar of black, and tipped with white. The middle of the lower surface of the tail is generally fulvous or even bright golden. The ears, which are well developed and pointed, are clothed internally and on the anterior surface with short yellowish- or reddish-brown hairs; the posterior border is narrowly edged with whitish, and there is a white spot at the base of the ear postero-internally.

The very large number of specimens before me indicate that the present species preserves great constancy of coloration. The variation exhibited by nearly a hundred New England skins consists merely in the more or less grayer cast of the upper surface in some than in others, in the sides being more strongly yellowish, and the rump of a darker or lighter shade of chestnut; the stripes vary somewhat in breadth and in the purity of their color. In a few specimens, the light stripes on the sides are nearly pure white (sometimes quite so anteriorly); in others, they are strongly yellowish or deep cream-color. The dark stripes are, in some specimens, twice as broad as in others. In No. 1568 (Coll. M. C. Z.), from Maine, the stripes are all very obscure, almost as pale as in the *T. "dorsalis"* of authors, and presents an exactly parallel phase of coloration. Melanistic examples are rare in this species. No. 1592 (Coll. M. C. Z.), however, from Norway, Me., is intensely black throughout, excepting a narrow white streak on the breast. Dr. Adams,\* however, states that he has met with several instances of melanism in this animal in New Brunswick.

Specimens from southern localities are considerably brighter-colored

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\* Field and Forest Rambles, p. 100.

than those from more northern sections, and average a little smaller. The difference, however, in either respect, is not very great.

This species is easily distinguished from its congeners by its coloration, as well as by other characters. Its nearest ally is the *T. asiaticus*; from the others (*T. harrisi* and *T. lateralis*), it is too distinct to require a comparison with them. The northern and eastern varieties of *T. asiaticus* (vars. *borealis*, *pallidus*, and *quadrivittatus*) differ from *T. striatus* in their considerably smaller size, in having the tail relatively longer (with the hairs as long as the head and body, instead of one-fourth shorter), and in having the markings on the sides of the head much stronger, and the black stripe of the dorsal surface broader (nearly or quite equalling the interspaces, instead of very much narrower), and continued much further, both anteriorly and posteriorly, the three middle ones reaching the base of the tail instead of terminating considerably in front of it. The inner light stripes are also not only much narrower but much lighter-colored than in *T. striatus*. The Columbia River variety of *T. asiaticus* (var. *townsendi*) is about equal in size to *T. striatus*, but differs from it in proportions in the same way as do the other varieties of *T. asiaticus*. The coloration, however, is still more widely different through the much browner coloration of var. *townsendi*. *T. striatus* differs from all the other members of the genus in possessing only one upper pre-molar instead of two, and in its more elongated and narrower muzzle.

SYNONYMY AND NOMENCLATURE.—This species was first described and figured by Catesby (though previously mentioned by Sagard-Théodat and other early writers\*), in 1743,† under the name *Sciurus striatus*. This

\* These early accounts are of especial interest from their giving the origin of the name *Suisse*, so generally applied to this and the following species by the French settlers of Canada and their descendants, even to the present time. In describing the Squirrels of Canada, Sagard-Théodat says:—"La seconde espèce qu'ils appellent Ohlhoïn, & nous Suisse, à cause de leur begarure, sont ceux qui sont rayés & barres universellement par tout le corps, d'une raye blanche, puis d'une rousse, grise & noirâtre, qui les rendent tres-beaux & agreables, mais qui mordent comme perdus, s'ils ne sont apprivoisés, ou que l'on ne s'en donne de garde."—(*Histoire du Canada*, tome v, p. 746.) Denys, in his "Description de l'Amérique Septentrionale" (tome ii, pp. 331), published in 1673, says of the same species:—" . . . Il y en a une espèce un peu plus petite qui se nomme Suisse parce qu'ils sont tous rayés de la teste à la queue par rayes blanche, rousse & noire toutes d'une même largeur d'environ la moitié d'un travers de doigt."

La Hontan also says:—"Les Écureuils Suisses, sont de petits animaux comme de petits rats. On les appellent Suisses parce qu'ils ont sur le corps un poil rayé de noir & de blanc, qui ressemble à un pourpoint de Suisse, & que ces mêmes rayes faisant un rond sur chaque cuisse ont beaucoup de rapport à la calote d'un Suisse."—(*Nouv. Voy. dans l'Amér.* tome ii, p. 43.) Charlevoix, writing somewhat later, says, in his account of the Squirrels of Canada:—"On en distingue de trois espèces; les rouges, qui ne diffèrent point des nôtres; les Suisses, qui sont un peu plus petite, & qu'on a ainsi nommée, parce que leur poil est rayé en longueur de rouge, de blanc & de noir; à peu près comme les Salises de la Garde du Pape."—(*Journ. Hist. d'un Voy. de l'Amér. Sept.* p. 196.)

† The description and figure given by Seba, in 1734, of his "*Sciurus, Gelulus, ex Nord Hesperia*" (Thesaur. i, 76, pl. xlvii, fig. 3), is doubtless to be referred to one of the species of *Tamias*, but whether to

name was adopted by Linnæus in 1754, who describes the species and cites the descriptions and figures of both Catesby and Edwards, and refers to no others.\* In the tenth edition of the *Systema Naturæ* (1758), Linnæus again describes his *Sciurus striatus*, of which he says, "Habitat in America septentrionali sub terra", and cites only Catesby, Edwards, and Kalm. His diagnosis is changed to read "*S. flavus striis*", etc., instead of "*Sciurus pallidus striis*", etc. In the twelfth edition of the same work, he gives its range as including Siberia, but his first reference is to his original description of *Sciurus striatus* (now further emended to read "*S. flavus striis quinque fuscis longitudinalibus*"), already cited; his second is to G. Gmelin's *Sciurus minor virgatus*,† which refers to a Siberian animal, Gmelin under this head giving the first description of the Europeo-Asiatic form of *T. asiaticus*. His other references are to Catesby, Edwards, and Kalm, whose descriptions refer exclusively to the Striped or Ground Squirrel of the Atlantic States. Pallas, in 1778, described the Siberian animal under the same name (*Sciurus striatus*). Although his description is based wholly on Siberian specimens, he also refers to *S. striatus* the American species, which he states he had not seen and knew only from authors, but from their accounts of it he considered it as evidently the same animal. Thus two distinct species became thoroughly confounded under the same name. Gmelin, in 1788, made the first division of the group, separating the Asiatic and American animals as *varieties*. The former is his *Sciurus striatus*,  $\alpha$ . *asiaticus* = *Sciurus striatus* Pallas, exclusive of his synonyms; the latter is his *Sciurus striatus*,  $\beta$ . *americanus* = *Sciurus striatus* of Catesby and Linnæus (*Mus. Ad. Frid.* and 10th ed. *Syst. Nat.*). In respect to the distribution of these forms, he says:—"Habitat  $\alpha$ ) in omni Asia boreali ad fluvios europæos Dwina et Kama usque,  $\beta$ ) in America septentrionali magis orientali minusque frigida ad novam Hispaniam usque." The references to the Siberian animal are properly brought together under the head of *asiaticus*, and the references *S. striatus* or to *S. asiaticus* var. *quadrivittatus* cannot well be determined. From the length of the tail, it would seem more likely to be the latter.

\* The account in full is as follows:—

"*SCIURUS STRIATUS.*

"*SCIURUS pallidus striis quatuor fasciis longitudinalibus.*

"*Sciurus striatus* Catesb. *Car.* 2. p. 75. t. 75. *Edw. Ornith.* 181. t. 181.

"Habitat in AMERICA septentrionali.

"*MAGNITUDO* Moris. Color pallidus, capite nigricanti, exserto in fascias 4. strias quatuor longitudinales, distantes, ad caudam extensas, quarum intermediæ latiores. Pedes palmis, tetractylis, plantis pentadactylis."—(*Mus. Adolphi Friderici Regis*, 1754, p. 8.)

† *Act. Petrop.* v, 1760, 344, pl. ix, fig. 1.

to the American animal under *americanus*. In 1820, Kuhl described an American specimen contained in Bullock's Museum as *Tamias americana*, stating that it differed from the *Sciurus striatus* of Pallas preserved in the Berlin Museum. He, however, makes no other reference to previous authors, and does not inform us whether he considered his "*T. americana*" to be a previously unknown species, or whether he intended merely to separate the American from the Siberian animal; but that he regarded it as a species previously unnoticed is the natural and usual inference. Fischer, in 1829, following Gmelin, makes the American animal a variety of the Asiatic, for which he adopts the name *americanus* (*Sciurus striatus* (Linn.) var. *americanus*), and says of its distribution:—"Communis in America septentr. nec non in Asia boreali." He quotes Linnæus's original diagnosis ("pallidus, striis 4 fuscis", etc.) in Mus. Ad. Frid., and cites Catesby, Lawson, Brickell, and Du Pratz. Fischer also gives as an additional species the "*Tamias americana*" of Kuhl. In the same year (1829), Richardson applied the name *lysteri* to the American animal, wrongly crediting the name to Klein, as had Desmarest before him. This name is based on Ray's "*Sciurus* a Cla. D. Lyster observatus", etc. The earliest use of the name *Sciurus lysteri* was doubtless made by Pallas in 1778, who cites "*Sciurus Listeri* RAJ. Syn. p. 216". Desmarest, in 1822, in his synonymy of *Sciurus striatus*, also cites "*Sciurus Lysteri*, Rai, Syn. quad. pag. 216". The name *lysteri* was subsequently adopted for the American species by Wager, Schinz, Audubon and Bachman, Giebel, Gray, and others, and almost uniformly accredited to Ray; while the name *striatus* was applied by the same writers exclusively to the Asiatic animal.

Professor Baird, in 1857, claimed the name *striatus* for the Ground Squirrel of Eastern North America, on the ground (as fully set forth in the preceding remarks) that the name was originally applied exclusively to American specimens. Finding, as he believed, the Asiatic species thus left without a name, he called it "*Tamias pallasii*, after the eminent naturalist who was the first to give an account of it to the world".\* The name *striatus* has since been currently adopted among American writers for the Striped or Ground Squirrel of Eastern North America, while Dr. Gray adopts for it Kuhl's name *americana*, and retains *striatus* for the Asiatic form. The use of *striatus* by Linnæus, in his tenth edition of the Systema Naturæ, strictly and solely for the American species, is sufficient to fully establish it as

\* Mam. N. Amer. p. 295.

belonging exclusively here, even if its earlier exclusive use in this sense be ignored on the ground that it antedates the introduction of the binomial system of nomenclature.

**GEOGRAPHICAL DISTRIBUTION.**—As will be seen by a reference to the subject list of specimens, the present species has quite an extensive geographical range, being found from Pembina, Minn., eastward to the Atlantic coast, and from the Red River Settlement and Canada to Georgia and Western Missouri. It is said to be common in the mountains of the Carolinas, and Audubon and Bachman state that "it is found in Tennessee and throughout Louisiana". It is not, however, found in the "alluvial districts of Carolina and Georgia", nor in Florida, and is presumably absent from all the lowlands of the Gulf coast, and probably not to be met with "throughout Louisiana", but only in the higher and more northerly portions. The authors above cited state that in South Carolina it is not found nearer the seaboard than Columbia. It is not enumerated by Roemer as an animal of Texas, nor is it mentioned as occurring in the Southwest beyond Western Missouri. Richardson gives it as common on the northern shores of Lakes Superior and Huron, but states it as his belief that it does not range northward beyond the fiftieth parallel. Hall enumerates it among the animals of Canada, and Gilpin among those of Nova Scotia.\* Adams gives it as very common in New Brunswick, as it likewise is in Maine and throughout the Northern States.

TABLE LX.—Measurements of ten skulls of *TAMIAS STRIATUS*.

Catalogue number.	Locality.	Sex.	Total length.	Greatest width.	Distance between orbits.	Nasal bone, length.	Nasal bone, width behind.	Nasal bone, width before.	Upper incisors from front to nodules.	Upper incisors from front to hinder margin of palate.	Upper incisors, height.	Upper incisors, width between external edges.	Upper molars, length taken together.	Lower jaw, length.	Lower jaw, height.
6183	Greensburg, Pa.	.....	1.52	0.83	0.41	0.50	0.12	0.26	0.49	0.78	0.30	0.16	0.35	0.34	0.38
6186	do	.....	1.45	0.77	0.40	0.50	.....	.....	0.49	0.71	0.19	0.14	0.35	0.19	0.37
6191	do	.....	1.56	0.90	0.43	0.55	0.15	0.30	0.53	0.79	0.30	0.14	0.33	0.38	0.40
6185	do	♂	1.54	0.85	0.44	0.50	.....	.....	0.58	0.80	0.30	0.15	0.34	0.38	0.40
6186	do	.....	1.59	0.87	0.42	0.53	.....	.....	0.56	0.88	0.28	0.16	0.33	0.30	0.43
6187	do	.....	1.54	0.87	0.45	0.51	.....	.....	0.52	0.77	0.29	0.15	0.33	0.38	0.41
6141	Alleghany, Pa.	.....	1.50	0.85	0.42	0.50	.....	.....	0.50	0.80	0.31	0.15	0.33	0.37	0.39
4944	Chester County, Pa.	.....	1.57	0.93	0.43	0.55	.....	.....	0.52	0.80	0.31	0.15	0.33	0.39	0.44
4945	do	.....	1.56	0.90	0.41	0.53	.....	.....	0.51	0.80	0.30	0.15	0.33	0.38	0.41
3843	Georgia	.....	1.45	0.77	0.41	0.50	.....	.....	0.47	0.78	0.18	0.13	0.34	0.30	0.40

\* Mr. R. R. McLeod, of Houlton, Me., also writes me that it is very numerous in Shelbourne, King's, and Queen's Counties in Nova Scotia.



TABLE LXI.—Measurements of twenty-seven specimens of TAMIAS STRIATUS.

Catalogue number.	Original number.	Locality.	Sex.	From tip of nose to—				Tail to end of—		Length of—		Nature of specimen when measured.
				Eye.	Ear.	Occiput.	Tail.	Vertebra.	Hairs.	Fore foot.	Hind foot.	
*1085	50	Ipswich, Mass.	♂	0.67	1.32	1.65	5.60	3.85	4.78	0.85	1.40	Fresh.
*1090	15	Newton, Mass.	♂	0.65	1.06	1.60	5.55	3.44	3.94	0.75	1.31	...do.
*1091	16	.....do.	♂	0.74	1.33	1.60	6.21	3.94	4.84	0.77	1.36	...do.
*1099	17	.....do.	♂	0.65	1.35	1.75	5.66	3.40	4.00	0.75	1.30	...do.
*1093	19	.....do.	♂	0.61	1.32	1.73	5.73	3.32	4.04	0.74	1.36	...do.
*1094	20	.....do.	♂	0.65	1.45	1.79	5.93	3.56	4.96	0.80	1.37	...do.
*.....	40	.....do.	♂	0.70	1.40	1.68	6.00	3.60	4.38	0.75	1.30	...do.
*2519	41	.....do.	♂	0.70	1.33	1.60	6.19	3.75	4.40	0.77	1.45	...do.
*1099	34	.....do.	♂	0.70	1.37	1.73	6.00	3.90	.....	0.78	1.35	...do.
*170	35	.....do.	♂	0.66	1.34	1.65	5.50	3.44	4.90	0.73	1.09	...do.
*1701	36	.....do.	♂	0.78	1.40	1.75	5.40	3.65	.....	0.78	1.30	...do.
*1702	30	.....do.	♂	0.70	1.97	1.70	5.37	3.86	.....	0.77	.....	...do.
*2080	40	.....do.	♂	0.78	1.40	1.70	5.70	3.73	4.41	0.70	1.25	...do.
*1704	51	.....do.	♂	0.71	1.42	1.75	5.60	3.40	3.80	0.75	1.40	...do.
*1705	53	.....do.	♂	0.75	1.35	1.75	5.89	3.45	3.85	0.80	1.36	...do.
*19478	.....	Oneida County, N. Y.	.....	0.76	1.40	1.80	6.08	3.02	4.30	0.78	1.40	Alcoholic.
*19479	.....	Nichols, Tioga County, N. Y.	.....	0.76	1.40	1.70	5.60	3.98	3.84	0.88	1.40	.....do.
*19480	.....	.....do.	.....	0.64	1.97	1.55	4.70	3.10	3.70	0.70	1.39	.....do.
*19481	.....	.....do.	.....	0.75	1.35	1.60	5.30	3.40	3.95	0.83	1.41	.....do.
*19482	.....	.....do.	.....	0.74	1.40	1.74	5.50	3.68	4.30	0.80	1.40	.....do.
*19483	.....	.....do.	.....	0.73	1.38	1.69	5.10	3.30	.....	0.75	1.40	.....do.
*19484	.....	.....do.	.....	0.72	1.40	1.75	5.60	3.78	4.53	0.78	1.40	.....do.
*19485	.....	.....do.	.....	0.69	1.28	1.57	5.70	3.00	3.75	0.75	1.35	.....do.
*19486	.....	.....do.	.....	0.66	1.25	1.40	5.70	3.36	4.10	0.80	1.35	.....do.
*19487	.....	.....do.	.....	0.80	1.50	1.78	5.63	3.34	.....	0.74	1.38	.....do.
*19488	.....	.....do.	.....	0.60	1.20	1.50	4.80	3.35	3.80	0.68	1.38	.....do.
*1735	.....	Racine, Wis.	.....	0.70	1.30	1.60	6.00	3.30	3.90	0.80	1.38	.....do.

\* In Museum of Comparative Zoology, Cambridge, Mass.

† From Baird, Mam. N. Amer. p. 205.

TABLE LXII.—List of specimens examined of TAMIAS STRIATUS.\*

Catalogue number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
*11540	3175	.....	.....	Pembina, Dak. Ter.	June 26, 1873	A. Campbell	Dr. E. Cones	Skin.
*11543	3177	.....	.....	.....do.	June 26, 1873	.....do.	.....do.	.....do.
*11544	3993	.....	.....	.....do.	June 14, 1873	.....do.	.....do.	.....do.
*11541	3176	.....	.....	.....do.	June 26, 1873	.....do.	.....do.	.....do.
*12550	.....	.....	.....	Red River Settlement.	.....	Dr. Evans	Dr. Evans	.....do.
*121	.....	.....	.....	Montreal, Canada.	.....	.....	.....	.....do.
*17105	.....	.....	.....	Matamoras, Tex.	.....	T. Richards	T. Richards	.....do.
*13003	.....	.....	.....	Princeton, Minn.	.....	O. E. Garrison	O. E. Garrison	.....do.
*1644	1796	.....	.....	Racine, Wis.	.....	Prof. S. F. Baird	Prof. S. F. Baird	Skin and skull
*1076	.....	.....	.....	Minneapolis, Minn.	.....	H. Mann, Jr.	H. Mann, Jr.	Alcoholic.
*1077	.....	.....	.....	.....do.	.....	.....do.	.....do.	.....do.

\* Considerable additional material belonging to the Museum of Comparative Zoology, not here mentioned, has also been used.

† In the National Museum, Washington, D. C.; all the others in Museum of Comparative Zoology, Cambridge, Mass.



TABLE LXII.—List of specimens examined of *TAMIAS STRIATUS*.—Continued.

Catalogue-number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
1410				Upton, Me.		J. G. Rich	J. G. Rich	Skin.
1411				do		do	do	do.
873				Norway, Me.		A. E. Verrill	A. E. Verrill	Alcohol.
936				do		Gray Fund.	B. D. Verrill	do.
1509				do		do	do	Skin.
610				do		do	do	Alcohol.
1568				Maine		L. Agassiz	L. Agassiz	Skin.
1569				do		do	do	do.
1570				do		do	do	do.
1571				do		do	do	do.
3740				Milan, N. H.		J. B. Fulsome	J. B. Fulsome	Alcohol.
906				Amherst, N. H.		Mrs A. M. Edmands	Mrs A. M. Edmands	do.
979				do		do	do	do.
3736				do		A. H. Mallondy	A. H. Mallondy	do.
3737				do		do	do	do.
3738				do		do	do	do.
3739				do		do	do	do.
3740				do		do	do	do.
1003				do		do	do	do.
990				do		do	do	do.
961				do		do	do	do.
1109				do		do	do	do.
1103				do		do	do	do.
984				Dummer, N. H.		John Vesey	John Vesey	do.
4917				Warwick, Mass.		F. W. Putnam	F. W. Putnam	do.
3745				Massachusetts		L. Agassiz	L. Agassiz	do.
3746				do		do	do	do.
3747				do		do	do	do.
3748				do		do	do	do.
759				do		do	do	do.
3756				Concord, Mass.		H. Mann, jr.	H. Mann, jr.	do.
153				do		do	do	Skin.
154				do		do	do	do.
3759				do		do	do	Alcohol.
753				Waltham, Mass.		C. Clark	C. Clark	do.
754				Essex County, Mass.		F. W. Putnam	F. W. Putnam	do.
755				Woburn, Mass.		J. G. Shute	J. G. Shute	do.
956				Yellow Springs, Ohio.		H. Mann, jr.	H. Mann, jr.	do.
960				Western New York.		L. Agassiz	L. Agassiz	do.
3557				Salem, Mass.		F. W. Putnam	F. W. Putnam	do.
3797				do		do	do	do.
3798				do		do	do	do.
3559				Springfield, Mass.		J. A. Allen	J. A. Allen	do.
3560				do		do	do	do.
3561				do		do	do	do.
1040				do		do	do	do.
1499				Massachusetts		L. Agassiz	L. Agassiz	Skin.
1500				do		do	do	do.
1501				do		do	do	do.
1578				do		do	do	do.
1573				do		do	do	do.
1574				do		do	do	do.

TABLE LXII.—List of specimens examined of TAMIAS STRIATUS—Continued.

Catalogue number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
1575				Massachusetts		L. Agassiz.	L. Agassiz	Skin.
1576				do		do	do	do
1577				Hudson, Mass.		S. Jilison	S. Jilison	do
1578				do		do	do	do
1600	15			Newtonville, Mass.		C. J. Maynard.	C. J. Maynard	do
1601	16			do		do	do	do
1602	17			do		do	do	do
1603	19			do		do	do	do
1604	20			do		do	do	do
1503	60	♂		do		do	do	do
1605	50			do		do	do	do
1606	21	♂		do		do	do	do
1607	24	♀		do		do	do	do
1608	35	♀		do		do	do	do
1609	34	♀		do		do	do	do
1700	35	♀		do		do	do	do
1701	36	♂		do		do	do	do
1702	39	♀		do		do	do	do
1703	48	♀		do		do	do	do
1704	51	♀		do		do	do	do
1705	58	♀		do		do	do	do
1706	60	♀		do		do	do	do
1707	69	♂		do		do	do	do
1709	70	♂		do		do	do	do
2509	78	♂		do		do	do	do
2510	75	♂		do		do	do	do
2511				do		do	do	do
2512	11	♂		do		do	do	do
2513	67	♀		do		do	do	do
2514	66	♀		do		do	do	do
2515	64	♂		do		do	do	do
2516	74	♂		do		do	do	do
2517	63	♀		do		do	do	do
2518	64	♂		do		do	do	do
2519	41	♂		do		do	do	do
2520	40	♀		do		do	do	do
2521	39	♂		do		do	do	do
2522	118	♀		Lake Umbagog, Me.		do	do	do
2523	118	♂		do		do	do	do
3204	187	♀		do		do	do	do
3205				do		do	do	do
3609	310	♀		do		do	do	do
3610	311	♀		do		do	do	do
3611	312	♂		do		do	do	do
3612	313	♀		do		do	do	do
3613	314	♀		do		do	do	do
957				Hadley, Mass.		T. W. Huntington.	T. W. Huntington.	Alcohol.
4916				Ware, Mass.		A. P. Chute	A. P. Chute	do
963				do		do	do	do
1007				Malden, Mass.		D. Higgins.	D. Higgins.	do
1008				do		do	do	do
1104				do		do	do	do

TABLE LXII.—List of specimens examined of *TAMIAS STRIATUS*—Continued.

Catalogue-number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
1105				Malden, Mass.		D. Higgins.	D. Higgins.	Alcohol.
3714				St. Lawrence Co., N. Y.		J. S. Foley	J. S. Foley	Skin.
3715				do		do	do	do
3716				do		do	do	do
3717				do		do	do	do
3718				do		do	do	do
959				do		do	do	do
*8090	183			Mount Carroll, Ill.		Dr. H. Shimer	Dr. H. Shimer	Skin and skull.
*1559	9491			Essex County, N. Y.		Dr. S. E. Hale	Dr. S. E. Hale	do
*1590	9393			do		do	do	do
*240	1899	♀		Elizabethtown, N. Y.	Aug. 14, 1895	Prof. S. F. Baird	Prof. S. F. Baird	do
*241	1899			do	Aug. 14, 1895	do	do	do
*249		♀		do	Aug. 14, 1895	do	do	Skin.
*968				do	Sept. —, 1895	D. Welsh	D. Welsh	do
1913				do		Prof. S. F. Baird	Prof. S. F. Baird	do
1914				do		do	do	do
*7936				Allegheny County, Pa.		E. L. Walker	E. L. Walker	do
*6141				do		do	do	Skull.
*6189				Greensburg, Pa.		F. Cowan	F. Cowan	do
*6185				do		do	do	do
*6184				do		do	do	do
*6185				do		do	do	do
*6186				do		do	do	do
*6187				do		do	do	do
*14				Carlisle, Pa.		Prof. S. F. Baird	Prof. S. F. Baird	do
*4944				Chester County, Pa.		Dr. E. Michter	Dr. E. Michter	do
*4946				do		do	do	do
*11140	4	♂		Washington, D. C.		Dr. E. Cones	Dr. E. Cones	Skin.
*7046		♀		do		do	do	do
*7098				do		C. Drexler	C. Drexler	do
*905	3001			do	Feb. —, 1899	Prof. S. F. Baird	Prof. S. F. Baird	Skin and skull.
*3843				Georgia.		A. Gerhardt	A. Gerhardt	Skull.
*3850				Wayne County, Ind.		E. Mendenhall	E. Mendenhall	Skin.
*3131		♂		Independence, Mo.		J. G. Cooper	J. G. Cooper	do
*3181		♂		do	May 30, 1897	do	do	do
*3184				do	May 30, 1897	do	do	do
*341	1236			Missouri.		Dr. P. E. Hoy	Dr. P. E. Hoy	Skin and skull.
*509	1644			Saint Louis, Mo.		Dr. G. Engelmann	Dr. G. Engelmann	do

\* In National Museum, Washington, D. C.; all the others in Museum of Comparative Zoölogy, Cambridge, Mass.

## TAMIAS ASIATICUS (Gmelin) Allen.

## Var. BOREALIS.

## Northern Chipmunk.

- Sciurus minor virgatus* G. Gmelin, Act. Petrop. v, 1760, 344, pl. ix, fig. 1 (Siberia).  
*Sciurus striatus* PALLAS, Nov. Gilrœ, 1778, 378 (not *S. striatus* of Catesby and Linnæus); Zoog. Rossæ-Asiat. i, 1831, 187.—SCHREBER, Säuget. iv, 1791, 790 (mainly).—DESMARET, Dict. d'Hist. Nat. x, 1817, 121 (in part); Mam. 1822, 339 (in part).—FISCHER, Synop. Mam. 1829, 348 (in part).  
*Sciurus striatus, a asiaticus* Gmelin, Syst. Nat. i, 1788, 150.  
*Sciurus (Tamias) quadricittatus* RICHARDSON, Zool. Journ. iii, 1829, 579; Faun. Bor.-Amer. i, 1829, 184, pl. xvi (mainly).  
*Tamias quadricittatus* WAGNER, AUDUBON & BACHMAN, BAIRD, GRAY, and of other authors, in part.—ROSS, Edinb. New Phil. Journ. xiii, 1861, 162; Nat. Hist. Rev. 1862, 274 (to 67° north).  
*Tamias pallasi* BAIRD, Ann. Rep. Smiths. Inst. for 1866, May, 1867, 55; Mam. N. Amer. 1867, 295.—LILLJEBORG, Faun. Öfver Sver. och Nor. Ryggr. 1871, 407.  
*Tamias quadricittatus* var. *pallasi* ALLEN, Proc. Bost. Soc. Nat. Hist. xvi, 1874, 290.  
*Tamias striatus* KEYSERLING & BLASIUS, Wirbelt. Europas, 1840, 43.—WAGNER, Suppl. Schreber's Säuget. iii, 1843, 231.—SCHINZ, Syn. Mam. ii, 1845, 47.—GIEBEL, Säuget. 1855, 639.—MIDDENDORFF, Sibirische Reise, ii, pt. 2, 1863, 83, pl. ii, fig. 10 (embryo).—SCHRENCK, Amur-Lande, i, 1859, 194.—GRAY, Ann. and Mag. Nat. Hist. 3d ser. x, 1867, 434.  
*Sciurus uthensis* PALLAS, Zoog. Rossæ-Asiat. i, 1831, 189 (melanistic). See also WAGNER, Suppl. Schreber's Säuget. iii, 1843, 232.—MIDDENDORFF, Sibirische Reise, ii, pt. 2, 1863, 83.—SCHRENCK, Amur-Lande, i, 1859, 195.

## Var. QUADRIVITTATUS.

## Rocky Mountain Chipmunk.

- Sciurus quadricittatus* SAY, Long's Exped. to Rocky Mts. ii, 1823, 45.—HARLAN, Faun. Amer. 1825, 180.—GODMAN, Amer. Nat. Hist. ii, 1886, 137.—HAMILTON-SMITH, Griffith's Cuvier's An. King. v, 1837, 265.—FISCHER, Synop. Mam. 1829, 350.—WAGNER, Schreber's Säuget. pl. ccxiv, A (*Tamias quadricittatus* in text).  
*"Spermophilus quadricittatus"* F. CUVIER, Suppl. Buffon, i, Mam. 1831, 240."  
*Tamias quadricittatus* WAGNER, Suppl. Schreber's Säuget. iii, 1843, 234 (in part).—SCHINZ, Synop. Mam. 1845, ii, 46.—AUDUBON & BACHMAN, Quad. N. Amer. i, 1849, 195, pl. xxiv.—CABOT, Agassiz's Lake Superior, 1850, 52 (northern shore of Lake Superior; common).—BAIRD, Mam. N. Amer. 1857, 297, pl. xx, fig. 2, head and feet (in part).—SUCKLEY, Nat. Hist. Wash. Ter. pt. iii, 1859, 97.—MAXIMILIAN, Archiv f. Naturgesch. 1861 81 (in part).—HAYDEN, Trans. Amer. Phil. Soc. Phila. xii, 1863, 145 (in part; mainly var. *pallidus*).—GRAY, Ann. & Mag. Nat. Hist. 3d ser. xx, 1867, 145 (in part).—STEVENSON, Hayden's Rep. U. S. Geol. Surv. Wyoming, 1871, 463.—MERRILL, U. S. Geol. Survey Terr. 6th Ann. Rep. 1873, 663.—ALLEN, Bull. Essex Inst. vi, 1874, 57, 59.—COUES & YARROW, Wheeler's Expl. and Surv. West of 100th Merid. v, Zool. 1876, 117.—GRINNELL, Ludlow's Black Hills of Dakota, 1876, 62.—HENSCHAW, Ann. Rep. Chief Engin. for 1876, App. JJ, 1876, 311 (Southern California).  
*Tamias quadricittatus* var. *quadricittatus* ALLEN, Proc. Bost. Soc. Nat. Hist. xvi, 1874, 289.  
*Tamias minutus* BACHMAN, Journ. Acad. Nat. Sci. Phila. viii, 1839, 77 (young); Townsend's Narrative, 1839, 323.—WAGNER, Archiv f. Naturgesch. 1843, pt. ii, 44 (same).—SCHINZ, Synop. Mam. ii, 1845, 43.

## Var. PALLIDUS.

## Pale Chipmunk.

- Tamias quadricittatus* AUDUBON & BACHMAN, BAIRD, GRAY, and others, in part.—HAYDEN, Trans. Amer. Phil. Soc. Phila. xii, 1863, 145.—GRINNELL, Ludlow's Rec. Black Hills, 1875, 81.  
*Tamias quadricittatus* var. *pallidus* ALLEN, Proc. Bost. Soc. Nat. Hist. xvi, 1874, 289.—COUES & YARROW, Wheeler's Expl. and Surv. West of 100th Merid. v, Zool. 1876, 117.

## Var. TOWNSENDI.

## Townsend's Chipmunk.

- Tamias townsendi* BACHMAN, Journ. Acad. Nat. Sci. Phila. viii, 1839, 68; Townsend's Narrative, 1839, 321.—WAGNER, Wiegmann's Archiv, 1843, pt. ii, 44.—AUDUBON & BACHMAN, Quad. N. Am. i, 1849, 159, pl. xx.—BAIRD, Mam. N. Am. 1857, 300, pl. xlv, fig. 4 (skull); pl. v, fig. 2 ("var. cooperi"; animal).—COOPER, Nat. Hist. Wash. Territory, pt. iii, 1859, 80.—SUCKLEY, ib. 97, 122.—GRAY, Ann. and Mag. Nat. Hist. 3d ser. xx, 1867, 435.
- Tamias townsendi* var. *cooperi* BAIRD, Mam. N. Am. 1857, pl. v (name on plate).
- Tamias hindsii* GRAY, Ann. and Mag. Nat. Hist. x, 1842, 284; Zool. Voy. of Sulphur, 1844, 34, pl. xii, fig. 1; Ann. and Mag. Nat. Hist. 3d ser. xx, 1867, 435.
- Tamias cooperi* BAIRD, Proc. Acad. Nat. Sci. Phila. vii, 1855, 334; Mam. N. Am. 1857, 301, foot-note.
- Tamias quadrimaculatus* GRAY, Ann. and Mag. Nat. Hist. 3d ser. xx, 1867, 435.

## Var. DORSALIS.

## Gila Chipmunk.

- Tamias dorsalis* BAIRD, Proc. Acad. Nat. Sci. Phila. vii, 1855, 332; Mam. N. Am. 1857, 300, pl. xvi, animal; U. S. and Mex. Bound. Survey, ii, pt. ii, 1859, 37.—GRAY, Ann. and Mag. Nat. Hist. 3d ser. xx, 1867, 436.—COUES, Amer. Nat. i, 1867, 368; Proc. Acad. Nat. Sci. Phila. 1867, 134 (Arizona).
- Tamias quadrivittatus* var. *dorsalis* ALLEN, Proc. Bost. Soc. Nat. Hist. xvi, 1874, 290.—COUES & YARROW, Wheeler's Expl. and Surv. West of 100th Merid. v, Zool. 1876, 119.

## Var. BOREALIS.

## Northern Chipmunk.

VARIETAL CHARs.—Size of var. *townsendi* or smaller. Length of head and body 5.50; of tail to end of vertebræ 3.92; to end of hairs 5.00 (*Pallas*). Above, pale yellowish-gray, with a faint wash of brownish-fulvous on the sides; back with five lines of black, alternating with four lines of yellowish-gray, all of nearly equal breadth and rather sharply defined; beneath, grayish-white; sides of the head with two narrow lines of grayish-white extending from the nose to the ear, separated by a brownish-black stripe; a narrow blackish-brown stripe above the light ones, and another below them. The middle black stripe of the back extends from the occiput to the base of the tail. The next on either side begins at the front edge of the shoulder and extends also nearly or quite to the base of the tail; the outer on either side extends only from the posterior edge of the shoulder to the hip. The black stripes are either not at all or only very faintly edged with pale rufous. The tail above is blackish, with the hairs pale yellowish at base crossed by a subterminal bar of black and tipped with white. The lower surface of the tail is pale yellowish centrally, with a subterminal border of black edged with yellowish-white.

HABITAT.—Northeastern Europe, Northern Asia, and Northwestern North

America southward nearly to the United States, decreasing in size and becoming brighter in color southward, in the interior, and thus passing gradually into var. *quadrivittatus*.

Var. QUADRIVITTATUS.

*Rocky Mountain Chipmunk.*

VARIETAL CHARs.—Length of head and body 4.50 to 5.00; of tail to end of vertebræ about 3.50; to end of hairs about 4.50. Pattern of coloration strictly the same as in var. *borealis*, but the colors brighter, with much more rufous, and the size smaller. Under parts sometimes faintly tinged with fulvous. The black dorsal stripes are edged and more or less mixed with rufous; the light stripes, particularly the outer, are whiter, varying from grayish-white to pure white; the sides of the body, especially anteriorly, are bright reddish-ferrugineous; the tail yellowish-rusty, with a subterminal border of black edged with yellowish.

HABITAT.—Middle and southern portions of the Rocky Mountains, from near the northern boundary of the United States to New Mexico. Also in the mountain-ranges, thence westward to the Pacific coast, and in the Black Hills. Most specialized in the mountains of Colorado. Passes insensibly, at the northward, into var. *borealis*; at the eastward and in the Great Basin, into var. *pallidus*; in Northern California and Oregon and in the Bitter Root and Cascade Ranges, into var. *townsendi*.

Var. PALLIDUS.

*Pale Chipmunk.*

VARIETAL CHARs.—Smaller and paler than var. *quadrivittatus*. Length of head and body 4.25; of tail to end of vertebræ 3.25; to end of hairs 4.00 to 4.25. General color above pale whitish-gray, the sides slightly washed with pale fulvous. The dark dorsal stripes are dusky, faded reddish-brown; outer pair of light stripes nearly white, inner grayish-white; generally only the middle dark stripe decidedly blackish. Yellow of the tail very pale clay-color.

HABITAT.—The dry plains of the Upper Missouri and Yellowstone and the desert plains of the Great Basin. Everywhere passing into var. *quadrivittatus* at the edges of the wooded mountain-ranges, of which it is merely a depauperate pallid form. The prevalent form over the plains of the Yellow-

stone and adjoining region, and of the arid districts of Wyoming, Southern Idaho, Utah, Nevada, Arizona, and New Mexico. Reaches an extreme phase of specialization in the Yellowstone region in respect to both pallor and smallness of size.

Var. TOWNSENDI.

*Townsend's Chipmunk.*

VARIETAL CHARs.—Size large, equalling that of Siberian specimens of var. *borealis*. Length of head and body 5.30; of tail to end of vertebræ 4.25; to end of hairs about 5.00. General color above nearly uniform dull rusty-brown, with usually five (sometimes only three) distinct longitudinal stripes of black. Intervals between the dark stripes generally, but not always, somewhat lighter than the general color; sometimes much lighter (yellowish-gray); occasionally the outer light stripes are clear grayish-white. Markings on the head the same in number, size, and position as in the preceding, but the light ones are more rufous and the dark ones blacker. The tail-hairs are deep rust-red at base, with a subterminal bar of black and clear grayish-white tips.

HABITAT.—Pacific coast, from Northern California to British Columbia; at the southward and eastward passing into var. *quadrivittatus* and at the northward into var. *borealis*. Most specialized near the mouth of the Columbia River, where it attains the largest size and darkest tints.

Var. DORSALIS.

*Gila Chipmunk.*

VARIETAL CHARs.—Of medium size for the species, being intermediate in this respect between the extreme phases of vars. *townsendi* and *quadrivittatus*. General color above ashen-gray, varied slightly with yellowish-brown; sides pale dull yellowish. Dorsal surface with a single blackish stripe along the middle of the back, extending from the occiput to the base of the tail. The other dorsal stripes are nearly or quite obsolete, though generally traceable; the outer white stripes generally more distinct than the others. Hairs of the tail pale rust (sometimes bright rusty-red) at the base, with a subterminal border of black edged with whitish. Markings of the head as in the other forms; the light stripes rather whiter (sometimes nearly pure white) than usual in the others.

Extremest phase of var. *townsendi*, holding the same relation to that form.

that var. *pallidus* does to var. *quadrivittatus*—a light gray form, in which all the dorsal stripes, except the central one, are nearly obsolete. I have yet to see a specimen in which there are not faint indications of the others. The specimens thus far known are nearly all from the desert region adjoining the Gila River.

**HABITAT.**—Southwestern New Mexico and adjoining portions of Arizona and Nevada.

GENERAL REMARKS ON TAMIAS ASIATICUS AND ITS VARIETIES.

**DIFFERENTIAL CHARACTERS.**—As already noticed under the head of *T. striatus*, the present species finds its nearest ally in *T. striatus*. In size, there is little difference between the larger varieties of *T. asiaticus* and *T. striatus*, the latter averaging rather the larger than any form of the former. The longer tail, different coloration, and presence of two upper premolars in *T. asiaticus*, as compared with *T. striatus*, serve at once to distinguish the two species. *T. asiaticus* differs too widely from either *T. lateralis* or *T. harrisi* to render a comparison with them necessary.

While the five varieties of *T. asiaticus* above characterized so thoroughly intergrade that they are not to be trenchantly defined, the extreme phases of differentiation are often quite widely diverse, and would require recognition as distinct species were they not found to be so inseparably connected. The extremes of the series in size as in color are vars. *pallidus* and *townsendi*, and are developed where the conditions of environment are the most diverse. Specimens from the same locality, of either variety, differ very considerably in color, and sometimes agree quite closely in this respect with the average type from a quite distant region. Thus, occasionally, specimens are met with in the wooded mountainous districts of Colorado that closely approach the pale form of the open arid plains. As will be seen from the subjoined lists of specimens, a considerable portion of the specimens I have had before me are as well referable to one variety as to another. These, as a rule, come from regions intermediate to the localities where the several forms above recognized reach respectively their greatest degree of differentiation.

Specimens from the northern portions of the continent are almost indistinguishable from others from Siberia. The two examples of the Siberian animal I have had an opportunity of examining correspond in every detail with examples from the Mackenzie River district and other northern



localities, as well as with the detailed descriptions given by authors of the Old World form. Examples from Fort Resolution, Fort Rae, Fort Liard, Fort Simpson, and Nelson's and Mackenzie Rivers are much paler than those from the region more to the southward, with less rufous edging to the black stripes of the back (many of them being quite without such edging, just as in Siberian examples) and less rufous on the sides of the body. Specimens taken along the forty-ninth parallel are intermediate between those from the far north and the bright richly-colored phase commonly met with in the mountains of Colorado. Many of the specimens from the Black Hills of Montana are equally rich in color with those from Colorado, being, in most cases, absolutely indistinguishable. Others of like tint come from the Uintah and Sierra Nevada Mountains. In the Coloradan or *quadrivittatus* form, the rufous of the sides assumes a peculiarly rich, lively tint of rust, the light dorsal stripes are whiter, and the dark ones are more intensely black and more narrowly edged with rufous. A much paler form is met with on the plains east of the Rocky Mountains, wherever the species is represented, becoming palest in the Mauvaises Terres region, where it also decreases very much in size. The form met with in the Rocky Mountain ranges north of the South Pass is larger, and has the rufous parts of a duller brown than is seen in the form which prevails in the mountains more to the southward. In the Bitter Root and Cascade ranges, the size still further increases, and the colors become still duller and heavier, passing here into the very large and peculiarly dark form of the coast region of Washington Territory and British Columbia. In this phase, the rufous tint of the sides no longer brightly contrasts with the general color of the dorsal surface, which has become of a nearly uniform shade of dull yellowish-rusty-brown, varied with three or five (generally five) more or less strongly defined longitudinal stripes of black; in many instances, the spaces between the stripes are not different in tint from the general color. In some cases, the general color is so dark that the outer black lines are effectually obscured, and the others are only dimly defined. In other examples, from the same region, the intervals between the dark lines are decidedly lighter than the general surface, varying in some specimens (especially the outer stripes) to grayish-white. The hairs of the tail become deep reddish-brown at the base, and tipped with white instead of yellowish-white. In passing southward, the size decreases, the general color lightens, especially on the sides, and the light and dark stripes become

more strongly differentiated. Specimens from Northern California show a strong resemblance to specimens from the Rocky Mountains near the forty-ninth parallel, and from the Bitter Root region; in some cases the white edging of the tail in the Californian form being the only really distinctive feature. Further southward still, in Southern California, the general colors become still paler and the dorsal surface grayer. The tail, however, retains the greater blackness and whiter edging which characterize the *townsendi* type. The desert region of the Gila River presents also a quite peculiar type, in which the general color of the dorsal surface becomes of a nearly uniform ashen-gray, with all the stripes obsolete except the middle one. Very few specimens of this form have as yet been received, and from finding occasionally specimens from other regions, and even also in another species (*T. striatus*), with the stripes but faintly developed, it seems possible that this form may be scarcely entitled to varietal recognition. I have seen specimens from the Great Salt Lake Valley and from Colorado with all the stripes except the central obsolete. Field observers, however, refer to it as a common form in Arizona and neighboring regions. In its rather full, bushy, white-edged tail and rather large size, it evidently finds its nearest ally in the Pacific-coast type, of which it is probably the desert representative. No. 3385, from Fort Defiance, New Mexico, however, agrees with var. *quadrivittatus*, except in the obsolescence of the stripes, the sides being strongly fulvous.

According to von Schrenck, the Asiatic animal presents everywhere great constancy of coloration. Even those of the partly open prairie-country of the Ussuri, he affirms, differ not in the slightest degree (*zeigen jedoch nicht die geringste Verschiedenheit*) from those of the coniferous forests about the mouth of the Amur River. He further adds that a specimen brought by Temminck from Japan was not in any way different from those from the Asiatic continent.\* So far as can be at present determined, the Siberian animal differs far less from that found in boreal America than does the latter from the form found in the Upper Missouri Bad Lands, the mountains of Colorado, or the region around Puget's Sound, or than these several strongly marked but demonstrably intergrading forms do from each other.

From the subjoined tables of measurements, it will be seen that the variation in size among American specimens ranges from an average length of

\* Amur-Lands, pp. 124, 125.

4.00 to 4.20 in the typical *pallidus* (from the Yellowstone Plains) to 5.25 in the *townsendi* type of the northwest coast; that the latter fully equals, and probably exceeds, in size the Siberian type; and that those from the Pacific coast are considerably larger than those from the interior, from localities having the same latitude; also, that in the interior there is a well-marked decline in size southward.\* The difference in dimensions between the smallest and largest form is about one-fourth of the average size of the whole series. The skull in var. *townsendi* has an average length of about 1.55, against 1.25 for the same measurement in var. *pallidus*.

Specimens from the eastern base of the Rocky Mountains, in latitude 49°, and from the Uintah Mountains and the region north of Fort Bridger, present a peculiar dull brownish phase of coloration, with the stripes very distinct and the sides pale. These are about equally well referable to either of three varieties, namely, *borealis*, *pallidus*, and *quadrivittatus*, though perhaps they most resemble *borealis*. They also show an approach to the dull, heavy tints of var. *townsendi*; particularly is this true of those from the Uintah Mountains.

The striking amount of variation with locality among the American forms of *Tamias asiaticus*, and its exact correlation with differences in the conditions of environment, make this one of the most instructive and interesting groups among North American Mammals. These correlations seem to have been first noticed by Dr. J. G. Cooper,† who, as early as 1869, in speaking of the pale form of *Tamias* "*quadrivittatus*" of the Upper Missouri Bad Lands, called attention to the difference in color seen between specimens inhabiting the open plains and the forests, and expressed his belief that the pale form of the Plains owed its paler tints and smaller size "to the influence of more sunlight and heat, combined with inferior food". He adds:—"Variations in color connected with exposure to the sun and heat, are noticed in *T. townsendi* and *T. striatus*, as well as in other animals, so that allowance must be made for such influences in the determination of species. The variety found by me in 1863, at the Clickatat Pass, Cascade Mountains, 4,500 feet above the sea, and at first named *T. cooperi* by Professor Baird, is so nearly intermediate between the form found on the west (*T. townsendi*) and

\* Unfortunately, I inadvertently omitted to take measurements of the northern specimens at the time (three years since) I had the whole material before me, which has since been widely dispersed.

† Amer. Nat. vol. ii, pp. 530, 531.

that on the east of those mountains (*T. quadrivittatus*) as to suggest a doubt of their distinctness, and at least a suspicion of a hybrid race."

**SYNONYMY AND NOMENCLATURE.**—As already shown (see *anted*, under *Tamias striatus*), the Old World form of *Tamias* was formerly confounded with the species of Eastern North America under the name *Tamias striatus*, which is still by many writers retained for the Old World type, though originally based exclusively upon the Striped Ground Squirrel of Eastern North America. The use of the name *striatus*, in this restricted sense, by Linnæus, in the tenth edition of the *Systema Naturæ*, renders it unequivocally pertinent to the latter species, and to that alone. The name *striatus* was first applied to the Siberian animal by Pallas twenty years after the publication of this edition of Linnæus's work, Pallas supposing it identical with the *striatus* of Linnæus. The first name distinctively applied to the Europeo-Asiatic form was *asiaticus*, given by Gmelin, in a varietal sense, in 1788, who properly discriminated the two forms, and correctly assigned their habitats and their synonymy. Professor Baird, apparently overlooking this fact, supposed, as late as 1857, that the Old World *Tamias* was without a name, and bestowed upon it that of *pallasi*. The only objection to *asiaticus* is its unfortunate geographical significance, since the Old World forms prove to be specifically the same as several of the forms of *Tamias* of Western North America, subsequently named *quadrivittatus*, *townsendi*, *dorsalis*, etc. Rigid adherence to the rule of priority renders it necessary to adopt *asiaticus* as the specific designation also of the American forms of this group, which will stand as above, namely, *Tamias asiaticus* vars. *quadrivittatus*, *townsendi*, etc.

The *Sciurus uthensis* Pallas, known only from Pallas's description, is commonly believed to have been based on a melanistic example of the common form. The species was originally described by Pallas, in 1831, from skins brought from the river Uth. The examples were wholly black, with *five* white dorsal stripes and a white streak on the throat and breast.\* Middendorff, von Schrenck, and other explorers have since diligently searched the same general region without meeting with other examples, and incline to the opinion that it is merely a melanistic form of the common species. The

\* Pallas states, in his diagnosis, "*S. auriculis imberbis, corpore atro strigis dorsilibus quinque albis*". It is further described as smaller than *Sciurus striatus*, with smaller ears and relatively shorter tail, but with the dorsal stripes similar ("*strigæ dorsales item similes*"), and with a longitudinal band of white on the throat, extending from the lower lip to the breast.

single black specimen of *T. striatus* I have seen was also marked on the throat with a longitudinal stripe of white, but was elsewhere wholly black.

GEOGRAPHICAL DISTRIBUTION.—The most easterly points from which I have seen specimens of this species are the northern shore of Lake Superior and Nelson's River, Hudson's Bay Territory. To the northward it ranges nearly to the Barren Grounds.\* In the United States, it is met with all along the forty-ninth parallel; it is common in the Bad Lands of the Upper Missouri and Yellowstone Rivers, in the Black Hills of Dakota, and in the eastern foot-hills of the Rocky Mountains southward to New Mexico. It is represented by some one of its forms thence westward to the Pacific coast, and as far southward as Arizona. In respect to the distribution of the several varieties, little need be said in addition to the remarks respecting their habits already given. The ranges of vars. *pallidus* and *quadrivittatus* curiously interblend, the latter occupying the wooded mountain-ranges of the Rocky Mountain plateau, while the former occurs generally over the sterile plains and desert areas from the Great Plains east of the Rocky Mountains to the Great Basin. East of the Missouri, the species appears to occur only in Northern Minnesota and Northern Dakota, its range gradually extending southward west of the Missouri. In the Upper Missouri country, Dr. Cooper† found them in the Bad Lands fifty miles west of Fort Union, and at the eastern base of the Rocky Mountains. I found them also common in the Bad Lands of the Yellowstone River,‡ and even as far eastward as the Little Missouri, and they occur doubtless thence westward to the Rocky Mountains, wherever there is shrubbery.

In the Old World, this species ranges from the shores of the Okotsk Sea westward over the whole of Northern Asia, and to the Dwina River in European Siberia. According to von Schrenck, it occurs on Saghalien Island, as far southward on the mainland as Hadshi Bay, in lat. 49°, and in the interior along the whole course of the Amur River and its tributaries. The same writer states that Temminck obtained it in Japan.

\* Respecting its range in the Fur Countries, Mr. Donald Gunn observes:—"I have not seen any of them in the Severn River District; but they are at Oxford House and Nelson River. They may inhabit other localities to the northeast of Lake Winnipeg."—(*MS. Notes to the Smithsonian Institution.*)

Mr. B. R. Ross gives its range as extending to Fort Good Hope, but as being "rare as Fort Simpson and north of Liard's River. At Fort Resolution and Liard, these animals are very destructive to such garden produce as is raised there."—(*MS. Notes to Smithsonian Institution.*)

† Amer. Nat. vol. ii, p. 530.

‡ Proc. Bost. Soc. Nat. Hist. xvii, 1874, 43.

TABLE LXIII.—Measurements of four specimens of TAMIAS ASIATICUS var. BOREALIS.

Catalogue number.	Locality.	From tip of nose to—			Tail to end of—		Length of—		Nature of specimen.	Remarks.
		Eye.	Occiput.	Tail.	Vertebrae.	Hairs.	Fore foot.	Hind foot.		
.....	Siberia.....	0.68	1.67	5.50	3.92	5.06	0.75	1.33	.....	From Pallua, Nov. Spec. Glire, p. 363.
1463	do.....	.....	.....	5.83	4.33	.....	.....	.....	Skin	From Wagner, Suppl. Schreber's Bllagot. II, 233.
1071	Eastern Siberia.	1.65	6.75	3.30	4.15	0.85	1.40	do	do	
		5.50	.....	.....	.....	.....	1.40	do	do	

TABLE LXIV.—Measurements of thirty specimens of TAMIAS ASIATICUS var. QUADRIVITTATUS.

Catalogue number.	Original number.	Locality.	Sex.	From tip of nose to—				Tail to end of—		Length of—		Height of ear.	Nature of specimen.
				Eye.	Ear.	Occiput.	Tail.	Vertebrae.	Hairs.	Fore foot.	Hind foot.		
*2733	599	Park County, Colo.....	♂	0.70	1.33	1.64	5.40	3.85	4.75	0.72	1.40	.....	Fresh.
*2734	687	do.....	♀	0.70	1.30	1.45	4.60	3.15	4.00	0.75	1.25	.....	do.
*2735	698	do.....	♂	0.72	1.27	1.45	5.00	2.80	3.80	0.72	1.53	.....	do.
*2736	719	do.....	♂	0.70	1.50	1.40	4.25	3.25	4.35	0.70	1.17	.....	do.
*2737	730	do.....	♀	0.73	1.32	1.42	4.85	3.40	4.30	0.70	1.50	.....	do.
*2738	815	Fairplay, Park County, Colo.....	♂	0.70	1.15	1.30	4.43	3.00	4.40	0.70	1.15	.....	do.
*2739	803	Montgomery, Park County, Colo.....	♂	0.60	1.10	1.35	3.85	3.10	4.00	0.57	1.13	.....	do.
*2740	894	do.....	♂	0.67	1.10	1.40	4.38	3.17	4.32	0.65	1.27	.....	do.
*2741	895	do.....	♂	0.58	1.03	1.27	3.45	3.05	4.35	0.56	1.04	.....	do.
*2742	896	do.....	♂	0.60	.....	.....	3.35	2.95	4.50	0.63	1.03	.....	do.
*2743	897	do.....	♂	0.70	1.15	1.35	4.13	3.45	4.00	0.70	1.15	.....	do.
*2744	898	do.....	♂	0.65	1.00	1.40	4.50	3.60	4.50	0.70	1.30	.....	do.
.....	1064	Percy, Carbon County, Wyo. Ter.....	♂	0.62	1.10	1.27	4.00	2.50	3.40	0.57	1.10	.....	do.
.....	.....	Fort Garland, Colo.....	♂	0.55	1.10	1.35	4.50	3.25	4.85	0.65	1.30	0.45	Alcoholic.
.....	.....	do.....	♀	0.55	1.12	1.50	4.70	3.50	4.40	0.63	1.22	0.44	do.
.....	.....	do.....	♀	0.50	1.10	1.25	4.30	3.10	4.00	.....	.....	0.46	do.
.....	.....	do.....	♂	0.50	1.10	1.22	4.55	3.30	4.50	.....	.....	.....	do.
.....	.....	do.....	♂	0.60	1.13	1.30	4.50	3.50	4.30	.....	.....	.....	do.
.....	9	South Park, Colo.....	♂	0.50	1.10	1.37	4.55	3.60	4.65	0.53	1.00	0.37	do.
.....	116	Twin Lakes.....	♂	0.53	1.08	1.35	4.25	3.40	4.55	0.53	1.30	0.35	do.
†11094	4318	Chief Mountain Lake.....	♀	0.55	1.30	1.50	4.20	.....	4.80	0.62	1.50	.....	Fresh.
†11090	4610	do.....	♂	0.55	1.30	1.50	4.10	4.25	4.90	0.65	1.30	.....	do.
†11096	4583	do.....	♀	0.50	1.30	1.50	4.75	3.70	4.60	0.70	1.30	.....	do.
†11088	4305	do.....	♀	.....	.....	.....	4.00	.....	4.75	.....	.....	.....	do.
†11092	4612	do.....	♂	0.55	1.30	1.50	4.10	4.30	5.10	0.60	1.30	.....	do.
†11095	4613	do.....	♂	0.55	1.30	1.50	4.40	4.10	5.00	0.60	1.20	.....	do.
†11089	4598	do.....	♂	0.55	1.30	1.50	4.40	3.30	4.70	0.60	1.30	.....	do.
†11093	4590	do.....	♂	0.55	1.30	1.50	4.25	3.75	4.75	0.65	1.30	.....	do.
†11081	4590	do.....	♂	0.60	1.30	1.50	4.90	3.60	4.60	0.70	1.30	.....	do.
†11097	4517	do.....	♂	0.55	1.30	1.50	4.20	4.00	4.20	0.62	1.30	.....	do.

\* Specimens in Museum of Comparative Zoology, Cambridge, Mass.

† The specimens from Chief Mountain Lake, 40th parallel, were measured fresh by Dr. Coues; they show considerable approach in coloration to var. borealis.

TABLE LXV.—Measurements of eleven specimens of *TAMIAS ASIATICUS* var. *PALLIDUS*.<sup>a</sup>

Catalogue-number.	Locality.	Sex.	From tip of nose to—				Tail to end of—		Length of—		Nature of specimen.
			Eye.	Ear.	Occiput.	Tail.	Vertebrae.	Hairs.	Fore foot.	Hind foot.	
9470	Yellowstone River .....	♂	0.50	1.07	1.35	4.05	3.95	4.10	0.61	1.18	Alcoholic.
9471	.....do .....	♂	0.50	1.10	1.30	4.10	3.10	4.00	0.55	1.30	.....do.
9472	.....do .....	♂	0.55	1.00	1.36	4.30	3.00	4.50	0.60	1.21	.....do.
9473	.....do .....	♂	0.50	1.10	1.30	.....	3.10	.....	0.50	1.30	.....do.
649	Fort Sarpy, Yellowstone River .....	♂	0.50	.....	1.32	4.00	3.50	4.50	0.60	1.17	Skin.
9475	Mouth of Judith River .....	♂	0.50	1.10	1.34	4.30	3.35	.....	0.55	1.30	Alcoholic.
9476	.....do .....	♂	0.50	1.10	1.35	4.30	3.59	4.40	0.50	1.23	.....do.
1908	Black Hills .....	♂	.....	.....	1.50	5.00	3.35	4.50	.....	1.09	Skin.
1907	Pole Creek .....	♂	.....	.....	.....	.....	5.38	2.90	3.25	1.15	.....do.
1910	North Platte .....	♂	.....	.....	1.50	5.00	3.25	4.25	.....	1.15	.....do.
1919	.....do .....	♂	.....	.....	.....	.....	3.25	4.00	.....	.....	.....do.

<sup>a</sup> Compiled from Baird's *Mamm. N. Amer.* p. 300.TABLE LXVI.—Measurements of twelve specimens of *TAMIAS ASIATICUS* var. *TOWNSENDI*.<sup>a</sup>

Catalogue-number.	Locality.	Sex.	From tip of nose to—				Tail to end of—		Length of—		Nature of specimen.
			Eye.	Ear.	Occiput.	Tail.	Vertebrae.	Hairs.	Fore foot.	Hind foot.	
1909	Cape Flattery, Wash. Ter .....	♂	0.65	1.35	1.60	5.30	4.70	5.50	0.80	1.45	Alcoholic.
9414	Stellacoom, Wash. Ter .....	♂	0.70	1.30	1.60	5.30	4.00	.....	0.70	1.50	.....do.
9415	.....do .....	♂	0.70	1.30	1.60	5.20	4.11	4.90	0.70	1.30	.....do.
9416	.....do .....	♂	0.70	1.35	1.60	5.40	4.30	5.00	0.90	1.40	.....do.
9417	.....do .....	♂	1.35	1.60	.....	5.00	4.50	4.90	0.80	1.35	.....do.
9418	.....do .....	♂	0.65	1.35	1.60	5.30	.....	.....	0.80	1.35	.....do.
9419	.....do .....	♂	0.65	1.30	1.50	5.10	.....	4.70	0.80	1.40	.....do.
9420	.....do .....	♂	0.70	1.30	1.55	5.10	.....	.....	0.80	1.40	.....do.
9421	.....do .....	♂	0.65	1.30	1.60	5.20	4.90	5.00	0.50	1.40	.....do.
9422	.....do .....	♂	0.60	1.30	1.50	4.50	3.85	4.70	0.60	1.30	.....do.
1582	Rodwood, Cal .....	♂	.....	1.80	.....	5.25	4.08	5.16	.....	.....	Skin.
9477	.....do .....	♂	0.73	1.52	1.80	5.00	4.60	5.40	0.88	1.50	Alcoholic.

<sup>a</sup> Compiled from Baird's *Mamm. N. Amer.* p. 303.TABLE LXVII.—Measurements of three skulls of *TAMIAS ASIATICUS* var. *PALLIDUS*.

Catalogue-number.	Locality.	Sex.	Total length.	Greatest width.	Distance between orbits.	Nasal bones, length.	Nasal bones, width behind.	Nasal bones, width before.	Upper incisors from front to molar.	Upper incisors from front to hinder margin of palate.	Upper incisors, height.	Upper incisors, width between external edges.	Upper molars, length taken together.	Lower jaw, length.	Lower jaw, height.
1-00	Yellowstone River .....	♂	1.25	0.75	0.31	0.38	0.11	0.90	0.40	0.60	0.16	0.12	0.30	0.71	0.25
9805	Pole Creek, Wyo. Ter .....	♂	1.36	0.75	0.31	0.38	.....	.....	.....	.....	.....	.....	.....	.....	.....
9280	.....do .....	♂	1.22	0.66	0.30	0.39	.....	.....	0.37	0.57	.....	.....	0.19	0.66	0.31

TABLE LXVIII.—Measurements of three skulls of TAMIAS ASIATICUS var. TOWNSENDI.

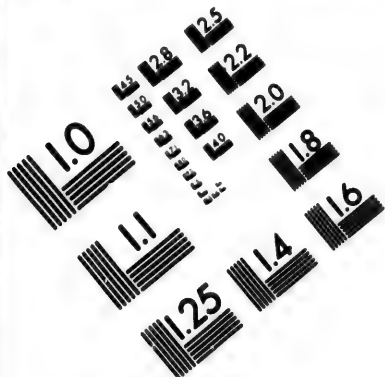
Catalogue number.	Locality.	Total length.	Greatest width.	Distance between orbits.	Nasal bones, length.	Nasal bones, width behind.	Nasal bones, width before.	Upper incisors from front to molars.	Upper incisors from front to hinder margin of palatine.	Upper incisors, height.	Upper incisors, width between external edges.	Upper molars, length taken together.	Lower jaw, length.	Lower jaw, height.
9400	Redwood, Cal. ....	1.60	0.89	0.36	0.36	0.16	0.14	0.54	0.80	.....	0.36	0.66	0.44	.....
6691	Washington Territory .....	1.50	0.85	0.37	0.45	0.13	0.08	0.50	0.76	0.94	0.16	0.25	0.85	0.38
2298	Cape Flattery, Wash. Ter. ....	1.46	0.80	0.34	0.46	0.16	0.23	0.44	0.74	0.80	0.13	0.36	0.61	0.40

TABLE LXIX.—List of specimens examined of TAMIAS ASIATICUS var. BORNEALIS.

Catalogue number.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
1463	.....	.....	Siberia. ....	.....	Dr. O. Hartlaub. ....	.....	Skin.
1971	.....	.....	Eastern Siberia. ....	.....	Imp. Mus. St. Petersburg. ....	.....	do.
3032	.....	.....	Nelson River, H. B. T. ....	.....	Donald Gunn. ....	Donald Gunn. ....	do.
3031	.....	.....	do. ....	.....	do. ....	do. ....	do.
4564	49	♂	Fort Simpson. ....	May 8, —	B. R. Ross. ....	B. R. Ross. ....	do.
4123	.....	.....	Oregon? ....	.....	Lieut. John Mullan. ....	Lieut. John Mullan. ....	do.
6309	7307	.....	Fort Resolution. ....	.....	A. McKenzie. ....	A. McKenzie. ....	do.
7066	650	.....	do. ....	Sept. 30, 1869	J. Lockhart. ....	J. Lockhart. ....	do.
7067	.....	.....	do. ....	Sept. 30, 1869	do. ....	do. ....	do.
7068	.....	.....	Fort Rae. ....	Sept. 30, 1869	L. C. Clark. ....	L. C. Clark. ....	do.
5637	.....	.....	MacKenzie River. ....	.....	R. McFarlane. ....	R. McFarlane. ....	do.
6306	1086	.....	Fort Liard. ....	.....	W. L. Hardisty. ....	W. L. Hardisty. ....	do.
6306	1084	.....	Salt River, H. B. T. ....	.....	B. R. Ross. ....	B. R. Ross. ....	do.
11542	2943	.....	Pembina, Dak. Ter. ....	June —, 1873	A. Campbell. ....	Dr. E. Coues. ....	do.
*1567	.....	.....	Lake Superior. ....	.....	L. Agassiz. ....	L. Agassiz. ....	do.
*1575	.....	.....	do. ....	.....	do. ....	do. ....	do.
11965	4567	.....	Bear's Paw Mountains, Mont. Ter. ....	July 25, 1874	A. Campbell. ....	Dr. E. Coues. ....	do.
11967	4517	♂	Chief Mountain Lake, B. Mts., etc. ....	Aug. 19, 1874	do. ....	do. ....	do.
11993	4566	♂	do. ....	Aug. 23, 1874	do. ....	do. ....	do.
11988	4565	♀	do. ....	Aug. 23, 1874	do. ....	do. ....	do.
11990	4610	♂	do. ....	Aug. 25, 1874	do. ....	do. ....	do.
11994	4518	♂	do. ....	Aug. 19, 1874	do. ....	do. ....	do.
11991	4596	♂	do. ....	Aug. 24, 1874	do. ....	do. ....	do.
11905	4613	♂	do. ....	Aug. 26, 1874	do. ....	do. ....	do.
11986	4583	♀	do. ....	Aug. 23, 1874	do. ....	do. ....	do.
11989	4582	♂	do. ....	Aug. 27, 1874	do. ....	do. ....	do.
11992	4612	♂	do. ....	Aug. 26, 1874	do. ....	do. ....	do.

\* In Museum of Comparative Zoology, Cambridge, Mass.





128  
125  
122  
120

10

TABLE LXX.—List of specimens examined of *TAMIAS ASIATICUS* var. *QUADRIVITTATUS*.

Catalogue number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Measure of specimen.	Remarks.
11460	.....	.....	.....	Colorado .....	—, 1873	Dr. F. V. Hayden.	J. H. Baily .....	Skin.	.....
11463	.....	.....	.....	do .....	—, 1873	do .....	do .....	do .....	.....
11464	.....	.....	.....	do .....	—, 1873	do .....	do .....	do .....	.....
11465	.....	.....	.....	do .....	—, 1873	do .....	do .....	do .....	.....
3763	.....	.....	1 ♀	Fort Massachusetts .....	.....	.....	.....	do .....	Rather strongly colored.
3825	.....	.....	.....	Wyoming Territory ? .....	.....	Dr. F. V. Hayden.	Dr. F. V. Hayden .....	do .....	.....
3836	.....	.....	.....	do .....	.....	do .....	do .....	do .....	.....
3837	.....	.....	.....	do .....	.....	do .....	do .....	do .....	.....
3339	.....	.....	.....	do .....	.....	do .....	do .....	do .....	.....
0349	.....	.....	.....	do .....	.....	do .....	do .....	do .....	.....
3037	.....	.....	113	Black Hills .....	Aug. 10, 1857	Dr. W. A. Hammond.	Dr. W. A. Hammond .....	do .....	.....
3038	.....	.....	.....	do .....	Aug. 10, 1857	do .....	do .....	do .....	.....
3070	.....	.....	308 ♂	do .....	July 10, 1857	do .....	do .....	do .....	.....
3073	.....	.....	341	Medicine Bow Mts. ....	July 27, 1857	La F. T. Bryan.	W. S. Wood .....	do .....	.....
3340	.....	.....	179 ♂	Fort Bridger .....	Apr. 11, 1858	W. M. F. McGraw.	C. Drexler .....	do .....	Approaching var. pallidus.
3341	.....	.....	170 ♀	do .....	Apr. 11, 1858	do .....	do .....	do .....	.....
3342	.....	.....	579 ♂	do .....	May 31, 1858	do .....	do .....	do .....	.....
3343	.....	.....	833 ♀	do .....	Nov. 16, 1858	do .....	do .....	do .....	.....
3344	.....	.....	364 ♂	do .....	June 4, 1858	do .....	do .....	do .....	.....
3345	.....	.....	171 ♂	do .....	Apr. 11, 1858	do .....	do .....	do .....	.....
3346	.....	.....	145 ♂	do .....	Apr. 4, 1858	do .....	do .....	do .....	.....
11119	19038	40	.....	Upper Geyser Basin .....	Oct. 2, 1878	Dr. F. V. Hayden	C. H. Merriam .....	do .....	Very bright.
11111	19097	39	♂	do .....	Oct. 2, 1878	do .....	do .....	do .....	.....
11110	19436	50	♂	do .....	Sept. 17, 1878	do .....	do .....	do .....	.....
0887	.....	.....	.....	Montana Territory .....	.....	.....	F. J. Hass .....	do .....	Exceedingly strongly colored.
0814	.....	.....	8	Pineau Valley Mts. ....	June 20, 1871	do .....	do .....	do .....	.....
0815	.....	.....	18	Virginia City Mts. ....	July 4, 1871	do .....	do .....	do .....	.....
0816	.....	.....	97	Yellowstone Lake .....	July 4, 1871	do .....	do .....	do .....	Extremely strongly colored.
0804	.....	.....	10	do .....	July 4, 1871	do .....	do .....	do .....	.....
11330	.....	.....	.....	Utah .....	.....	L. G. M. Wheeler	H. W. Henshaw .....	do .....	Very strongly colored.
11330	.....	.....	.....	do .....	.....	do .....	do .....	do .....	.....
11331	.....	.....	.....	do .....	.....	do .....	do .....	do .....	.....
11330	.....	.....	.....	do .....	.....	do .....	do .....	do .....	.....
11150	.....	.....	.....	Chovaler .....	.....	.....	F. Blanford .....	do .....	Faint, but the black stripes very strong.
5468	.....	.....	.....	Sangre del Cristo Pass .....	.....	John Xantus .....	John Xantus .....	do .....	.....
4130	.....	100	.....	Bitter Root Mountains .....	.....	La. John Mallon.	John Pearson .....	do .....	.....
4131	.....	190	.....	do .....	.....	do .....	do .....	do .....	.....
4130	.....	190	.....	do .....	.....	do .....	do .....	do .....	.....
*2723	.....	380	.....	Reed's Mts., Park Co., Co's.	July 7, 1871	Rocky Mountain Expedition.	Allen, Bennett, and Bliss .....	do .....	.....
*2734	.....	697 ♀	.....	do .....	July 8, 1871	do .....	do .....	do .....	.....
*2735	.....	698 ♀	.....	do .....	July 8, 1871	do .....	do .....	do .....	.....
*2736	.....	710 ♂	.....	do .....	July 13, 1871	do .....	do .....	do .....	.....
*2737	.....	720	.....	Fairplay, Park County, Colo.	July 18, 1871	do .....	do .....	do .....	.....

\* In Museum of Comparative Zoology, Cambridge, Mass.

TABLE LXX.—List of specimens examined of TAMIAS ASIATICUS var. QUADRIVITTATUS—Continued.

Catalogue-number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.	Remarks.
*8738	845	...	...	Montgomery, Park Co., Colo.	July 28, 1871	Rocky Mountain Expedition.	Allen, Bennett, and Bliss.	Skin.	
*8739	893	♂	...	do	July 28, 1871	do	do	do	
*8740	894	♂	...	do	July 28, 1871	do	do	do	
*8741	895	♀	...	do	July 28, 1871	do	do	do	
*8742	896	♂	...	do	July 28, 1871	do	do	do	
*8743	897	♂	...	do	July 28, 1871	do	do	do	
*8744	898	♀	...	do	July 28, 1871	do	do	do	
9000	...	...	...	Idaho City, Colo. Ter.	July 16, 1889	Dr. F. V. Hayden.	J. Stevenson	do	
9001	...	...	...	do	July 16, 1889	do	do	do	
9002	...	...	...	Seda Springs, Colo. Ter.	Aug. 10, 1889	do	do	do	
9003	...	...	...	Don Carlos, Colo. Ter.	Aug. 10, 1889	do	do	do	

\* In Museum of Comparative Zoology, Cambridge, Mass.

TABLE LXXI.—List of specimens examined of TAMIAS ASIATICUS var. PALLIDUS.

Catalogue-number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.	Remarks.
13774	...	...	...	Utah.	...	Capt. J. H. Simpson.	C. S. McCarthy	Skin.	Extremely pale.
9398	934	♂	...	Humboldt Mts.	...	Charles King	R. Ridgway	do	Medium color.
9399	933	♂	...	do	...	do	do	do	Very pale.
9403	606	...	...	Henry's Fork of Green River.	Oct. 4, 1874	Dr. F. V. Hayden.	H. D. Schmidt	do	Very pale, but not of the palest type.
9403	606	...	...	Green River, Wyo.	Oct. 10, 1874	do	do	do	do
9404	716	...	...	do	Oct. 13, 1874	do	do	do	do
9405	708	♂	...	do	Oct. 13, 1874	do	do	do	do
9406	709	♂	...	do	Oct. 13, 1874	do	do	do	do
9407	709	...	...	do	Oct. 14, 1874	do	do	do	do
9408	702	...	...	Blister Creek, Wyo.	Oct. 14, 1874	do	do	do	do
9409	704	...	...	do	Oct. 15, 1874	do	do	do	do
9410	705	...	...	do	Oct. 16, 1874	do	do	do	do
9411	885	...	...	Sulphur Springs, Wyo.	Oct. 15, 1874	do	do	do	do
9412	886	...	...	do	Oct. 15, 1874	do	do	do	do
9413	810	...	...	North Platte River	Oct. 20, 1874	do	do	do	do
9414	888	...	...	do	Oct. 22, 1874	do	do	do	do
9415	888	...	...	do	Oct. 22, 1874	do	do	do	do
3773	...	♀	...	Green River, Wyo.	Aug. 20, 1856	Capt. Simpson	C. S. McCarthy	do	do
3774	...	...	...	do	Aug. 30, 1856	do	do	do	do
11086	380	...	...	Camp Thorne, Yellowstone R., M. T.	July 18, 1873	Gen. D. A. Stanley.	J. A. Allen	do	Very pale.
11087	180	...	...	do	July 18, 1873	do	do	do	do
11088	180	...	...	do	July 18, 1873	do	do	do	do
11089	18	...	...	Powder River, M. T.	July 26, 1873	Capt. W. F. Reynolds.	Dr. F. V. Hayden.	do	do

TABLE LXXI.—List of specimens examined of *TAMIAS AMERICANUS* var. *PALLIDUS*—Continued.

Catalogue number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.	Remarks.
.....	.....	17	....	Powder River, M. T.	July 26, 1873	Capt. W. F. Reynolds.	Dr. F. V. Hayden.	Skin .....	Very pale.
.....	.....	20	....	Mispah Creek.....	.....	.....	.....	.....	.....
.....	.....	25	....	do .....	.....	.....	.....	.....	.....
9008	.....	304	....	North Platte, Wyo.	Aug. 24, 1870	Dr. F. V. Hayden.	H. D. Schmidt.	.....	.....
9003	.....	303	....	do .....	Aug. 24, 1870	.....	.....	.....	.....
9004	.....	300	....	do .....	Aug. 24, 1870	.....	.....	.....	.....
9005	.....	333	....	Pacific Springs.....	Sept. 4, 1870	.....	.....	.....	Darker.
9006	.....	336	....	do .....	Sept. 4, 1870	.....	.....	.....	.....
9007	.....	345	....	Little Sandy, Wyo.	Sept. 6, 1870	.....	.....	.....	Less dark, nearly of the palest type.
9008	.....	304	....	Green River, Wyo.	Sept. 8, 1870	.....	.....	.....	.....
9009	.....	378	....	Big Sandy, Wyo.	Sept. 7, 1870	.....	.....	.....	.....
9070	.....	418	....	Green River, Wyo.	Sept. 10, 1870	.....	.....	.....	.....
9071	.....	438	....	do .....	Sept. 11, 1870	.....	.....	.....	.....
9072	.....	438	....	do .....	Sept. 11, 1870	.....	.....	.....	.....
1323	.....	.....	....	.....	.....	.....	Dr. F. V. Hayden.	.....	.....
2530	.....	.....	....	.....	.....	.....	.....	.....	.....
3040	.....	.....	....	.....	.....	.....	.....	.....	.....
1773	.....	.....	....	Yellowstone River.	Sept. 3, —	.....	.....	.....	.....
1774	.....	♂	....	do .....	Aug. 18, 1868	.....	.....	.....	.....
649	1800	.....	....	do .....	.....	.....	.....	Skin and skull.	.....
6280	.....	.....	....	Wind River.....	.....	.....	.....	Skin .....	.....
6279	.....	.....	....	do .....	May 30, —	.....	.....	.....	.....
6281	.....	.....	....	do .....	.....	.....	.....	.....	.....
6278	.....	.....	....	do .....	.....	.....	.....	.....	.....
.....	.....	4773	....	Nebraska.....	.....	.....	.....	Skin and skull.	.....
3071	.....	333	....	North Platte.....	July 26, 1873	.....	W. S. Wood.	Skin .....	.....
1307	9006	.....	....	Pole Creek.....	.....	.....	.....	Skin and skull.	.....
9384	933	♂	....	Humboldt Mts., Nev.	.....	Clarence King	Rob't Ridgway	Skin .....	Very pale.
9385	934	♂	....	do .....	.....	.....	.....	.....	Medium.
9386	303	....	....	Truckee Valley, Nev.	.....	.....	.....	.....	Quite bright.

TABLE LXXII.—List of specimens examined of *TAMIAS ASIATICUS* var. *TOWNSENDI*.

Catalogue number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
1201	2888			Cape Flattery, Wash. T.		L. W. P. Trowbridge	L. W. P. Trowbridge	Skin and skull.
98				Columbia River		Phil. Acad. Nat. Sci.	J. E. Townsend	Skin.
1854				Fort Steilacoom, Wash. T.	Apr. 16, 1856	Dr. Geo. Buckley	Dr. Geo. Buckley	do.
1901	81	♂		do	Y. L. —, 1856	do	do	do.
1938	86	♂		do	Mar. —, 1856	do	do	do.
554	12			do	June —, 1854	do	do	do.
857				do	do	do	do	do.
903	1274			do	do	do	do	Skin and skull.
1286		♀		do	June —, 1855	Gov. L. I. Stevens	Dr. J. G. Cooper	Skin.
1379		♂		do	June —, 1855	do	do	do.
911	1180			do	do	do	do	Skin and skull.
913	1183			do	do	do	do	do.
9460		18	♂	Shoalwater Bay, Wash. T.	do	do	do	Skin.
1381				do	Aug. 26, 1855	do	do	do.
607				Astoria	do	do	do	do.
8315				Fogot Sound	do	J. G. Swan	J. G. Swan	do.
3176	6081	90		do	do	Dr. C. B. R. Kennerly	Dr. C. B. R. Kennerly	Skin and skull.
1388	9418			Redwood, Sonora Co., Cal.	do	E. Sennels	E. Sennels	do.
	9409			do	do	do	do	Skull.
536				Fort Reading	do	Dr. J. F. Hammond	Dr. J. F. Hammond	Skin.
3498				Fort Crook, Cal.	do	Capt. John Putner	Capt. John Putner	do.

TABLE LXXIII.—List of specimens examined of *TAMIAS ASIATICUS* var. *DOBESALIS*.

Catalogue number of skin.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
7883	716	♀	Fort Whipple, Ariz.	Sept. 8, 1884	Dr. R. Coates	Dr. R. Coates	Skin.
7885	671	♀	do	Aug. 27, 1884	do	do	do.
2265			Fort Defiance, N. Mex.	do	Dr. J. R. McKee	Dr. J. R. McKee	do.
11120			Ogden, Utah	June 4, 1878	Dr. F. V. Hayden	C. H. Merriam	do.
119			Coppermine, Gila River	do	Col. J. D. Graham	J. H. Clark	do.
120			do	do	do	do	Mounted.
11873	663		El Moro, N. Mex.	July 23, 1873	Lieut. G. M. Wheeler	H. W. Henshaw	Skin.

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TABLE LXXIV.—List of specimens examined of *TAMIAS ASIATICUS* variously intermediate between *vars.* BOREALIS, QUADRIVITTATUS, and TOWNSENDI.

Catalogue-number.	Original number.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.	Remarks.
9673	512	Utah Mountains	Sept. 30, 1870	Dr. F. V. Hayden	H. D. Schmidt	Skin	
9674	514	do	Sept. 30, 1870	do	do	do	
9675	517	do	Sept. 30, 1870	do	do	do	
9676	519	do	Sept. 30, 1870	do	do	do	
9677	519	do	Sept. 30, 1870	do	do	do	
9678	545	do	Sept. —, 1870	do	do	do	
9679	568	do	Sept. —, 1870	do	do	do	
9680	564	do	Sept. —, 1870	do	do	do	
4190		Bitter Root Mountains		Lieut. John Mullan	John Pennell	do	
93		Columbia River		Phil. Acad. Nat. Sci.	J. E. Townsend	do	
303		Washington Territory	July 30, 1853	Gov. L. I. Stevens	Dr. J. G. Cooper	do	
904		Blue Mountains, Oreg.	Oct. 9, 1854	Dr. Geo. Sackley	Dr. Geo. Sackley	do	
4673		Fort Crook, Cal.	Sept. 27, 1860	D. F. Parkinson	D. F. Parkinson	do	
4664		do	Sept. 27, 1860	do	do	do	

Specimens of large size and dark color, with the black stripes very broad, etc.

TABLE LXXV.—List of specimens examined of *TAMIAS ASIATICUS* intermediate between *vars.* QUADRIVITTATUS and PALLIDUS.

Catalogue-number.	Original number.	Sex and age.	Locality.	From whom received.	Collected by—
3064			Calton Las Uvas, Cal.	John Xantus	John Xantus
3065			Fort Tejon	do	do
3067			do	do	do
3050	167	♀	Fort Crook, N. Cal.	Capt. John Fullmer	Capt. John Fullmer
3319			Fort Burgwyn, N. Mex.	Dr. W. W. Anderson	Dr. W. W. Anderson
3700			Fort Massachusetts, N. Mex.	Capt. E. C. Bowman	Capt. E. C. Bowman
3761			do	do	do
3768	4		do	do	do
3184	28		do	Dr. D. C. Peters	Dr. D. C. Peters

## TAMIAS HARRISI (Aud. &amp; Bach.) Allen

## Harris's Chipmunk.

*Spermophilus harrisi* AUDUBON & BACHMAN, Quad. N. Am. iii, 1854, 267, pl. cxliv, fig. 1.—BAIRD, Mém. N. Am. 1857, 313, pl. xlviii, fig. 3 (skull).—COUES, Amer. Nat. i, 1867, 369 (Western Arizona).—ALLEN, Proc. Bost. Soc. Nat. Hist. xvi, 1874, 391.—COUES & YARROW, Wheeler's Expl. and Surv. W. 100th Merid. v, Zool. 1876, 120 (Lava Beds, Southern Utah).—HENSCHAW, Ann. Rep. Chief Engineers for 1876, App. JJ, 1876, 311 (Southern California).

SPECIFIC CHAR.—Length of head and body 5.00; of tail to end of vertebrae 2.65; to end of hairs 3.50. Above, finely grizzled grayish-brown,

lighter anteriorly and more vinaceous posteriorly, with a narrow white line on each side extending from the shoulder to the hip. Ring surrounding the eye and lower parts pale yellowish-white, varying to clear white. Sides of the body below the white line, especially on the limbs externally, washed with a pale shade of chestnut. Tail flat; above, black, varied and edged with white; lower surface white centrally and at the edges, with a subterminal bar of black. The hairs of the sides of the tail and some of those of the upper surface are black at the extreme base as well as subterminally. Ears small, pointed, clothed with short hairs. Soles partly naked in summer, well clothed in winter. The winter pelage (especially at the northward) is full, soft, and silky; that of the back mostly white beneath the surface. In summer, particularly in Cape Saint Lucas specimens, the pelage is very short, stiff, and harsh.

In this species, the variations in color are very slight. The light markings range from nearly pure white to soiled yellowish-white; the sides vary slightly in the amount of chestnut they present, and the prevailing tint of the dorsal surface varies from gray to pale vinaceous. The hairs are black at the base; those of the dorsal surface, in winter, are mainly white below the surface, with narrow basal and subterminal bars of black and yellowish-gray tips. In summer specimens, the pelage is very short and stiff, with no under fur; in winter, long, very soft, with an abundance of silky under fur.

The present species differs from the other members of the group mainly in having much smaller ears, a shorter tail than either *T. asiaticus* or *T. striatus*, and in wholly lacking the black dorsal stripes present in all the others. The absence of these, as well as its short ears, serves at once to distinguish it among its congeners. It is, in the average, rather smaller than *T. striatus*, but rather exceeds in size the smaller varieties of *T. asiaticus*. It also differs somewhat in habits and in the form of the angle of the lower jaw. It might, in fact, perhaps stand as the type of a new subgenus, coming nearer to *Tamias* than to *Spermophilus*. Its chief points of difference from the typical Ground Squirrels consist in its smaller ears and in the very much greater development of the angle of the mandibular ramus, which gives rise to a more strongly marked ascending square process at the posterior upper border.

*Tamias harrisi* was first described by Audubon and Bachman in 1854, from a single specimen obtained by Mr. J. K. Townsend on his journey to Oregon, but the precise locality was unknown. Its habitat was first accu-



rately ascertained by Dr. A. L. Heermann in 1853, who at that time transmitted specimens to the Smithsonian Institution. The species was redescribed by Professor Baird in 1859, from Dr. Heermann's specimen, and from a skin in alcohol received from Mr. J. G. Bell, who erroneously supposed it came from Wisconsin. Soon after this date, a large *suite* of more than twenty specimens was received at the Smithsonian Institution from Mr. John Xantus, who collected them about San José and Cape Saint Lucas, at the southern extremity of the peninsula of Lower California. It has been since obtained by Dr. D. C. Peters, at Fort Massachusetts, N. Mex.; by Dr. Palmer, at Camp Grant, Ariz.; by Mr. F. Bischoff, in Nevada;\* and by Mr. H. W. Henshaw, at Cove Creek, Utah, and in Southern California. Its known range hence extends from Northwestern New Mexico westward across Southern Utah and Southern Nevada to California, and southward along the coast to the southern point of Lower California. It probably extends in the interior far southward into Western Mexico. It is, however, essentially a species of the deserts. Mr. Henshaw† speaks of it as living in communities, on dry sandy plains, where there is very little vegetation. It thus differs in habits from the other species of *Tamias*, which are all woodland species, and in its preference for open plains quite resembles the *Spermophiles*.

TABLE LXXVI.—Measurements of five skulls of *TAMIAS HARRISI*.

Catalogue-number.	Locality.	Sex.	Total length.	Greatest width.	Distance between orbits.	Skull bones, length.	Skull bones, width behind.	Skull bones, width before.	Upper incisors from front to back.	Upper incisors from front to back margin of palata.	Upper incisors, height.	Upper incisors, width between external edges.	Upper molars, length taken together.	Lower jaw, length.	Lower jaw, height.
4039	Cape St. Lucas, L. Cal. ....	♀	1.87	0.95	0.46	0.45	0.19	0.22	0.55	0.36	0.33	0.14	0.36	0.93	0.47
4038	.....do.....	♀	1.80	0.90	0.46	0.47	0.15	0.24	0.58	0.35	0.35	0.16	0.36	0.93	0.47
4146	.....do.....	♀	1.80	0.93	0.77	0.49	.....	.....	0.48	0.31	0.33	0.16	0.30	0.90	0.45
4147	.....do.....	♀	1.55	0.85	0.33	0.47	.....	.....	0.50	0.30	.....	.....	0.30	0.85	0.46
4156	San José, L. Cal. ....	♂	1.85	0.95	0.46	0.48	.....	.....	0.50	0.31	0.35	0.15	0.35	0.95	0.45

\* Dr. Coues informs me that he has inspected a drawing of a specimen secured at Pyramid Lake, Nevada.

† Ann. Rep. Chief Engineers for 1876, App. JJ, p. 311.

TABLE LXXVII.—Measurements of six specimens of TAMIAS HARRISI.

Catalogue number.	Original number.	Locality.	From tip of nose to—					Tail to end of—		Length of—		Height of ear.	Measure of specimen.
			Ear.	Eye.	Ear.	Occiput.	Tail.	Vertebrae.	Hairs.	Fore foot.	Hind foot.		
5881	388	Treelake Meadows, Nev.	.....	0.76	1.35	1.00	5.90	1.75	2.25	0.90	1.40	0.20	Skin.
5883	.....	Camp Grant, Ariz.	♂	0.83	1.15	1.00	5.95	2.00	2.50	0.90	1.35	0.20	do.
5840	6647	San José, Cal.	♂	.....	.....	.....	5.90	2.05	2.25	0.90	1.40	0.20	do.
5831	592	Cape St. Lucas.	♂	.....	.....	.....	5.90	2.10	2.70	0.90	1.40	0.27	do.
5893	378	.....do.	♂	.....	.....	.....	5.90	2.20	2.90	0.75	1.40	.....	do.
671	.....	Mohave Desert.	.....	.....	.....	1.00	5.50	2.05	2.91	.....	1.33	.....	do.

TABLE LXXVIII.—List of specimens examined of TAMIAS HARRISI.

Catalogue number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Measure of specimen.
5883	.....	.....	.....	Camp Grant, 90 miles east of Tucson.	June 26, 1899	Dr. E. Palmer.....	Dr. E. Palmer.....	Skin.
3268	.....	.....	.....	90 miles west of the Colorado.	.....	Lt. J. C. Ives.....	J. Williamson.....	do.
11149	.....	.....	.....	Nevada.....	Aug. —, 1878	.....	F. Blachoff.....	do.
11353	404	♂	.....	Cove Creek, Utah.	Nov. 13, 1878	Lt. G. M. Wheeler...	Yarrow and Henshaw.	do.
11353	415	♀	.....	do.	Nov. 17, 1878	do.	do.	do.
3183	.....	.....	.....	Fort Massachusetts.	.....	Dr. D. C. Peters.....	Dr. D. C. Peters.....	do.
5861	306	♀	.....	Cape St. Lucas, L. Cal.	.....	John Xantus.....	John Xantus.....	do.
5866	378	♂	.....	do.	.....	do.	do.	do.
5863	378	♂	.....	do.	.....	do.	do.	do.
5819	378	♀	.....	do.	Apr. —, 1899	do.	do.	do.
5861	680	♀	.....	do.	June 15, 1899	do.	do.	do.
5863	370	♂	.....	do.	May —, 1899	do.	do.	do.
5864	373	♂	.....	do.	Apr. —, 1899	do.	do.	do.
5866	361	♂	.....	do.	Apr. —, 1899	do.	do.	do.
5869	680	♀	.....	do.	.....	do.	do.	Skin and skull.
5831	408	♀	.....	do.	June —, 1899	do.	do.	do.
5893	417	1944	♀	do.	Aug. 14, 1899	do.	do.	do.
5864	416	.....	.....	do.	.....	do.	do.	do.
5877	.....	.....	.....	do.	June 15, 1899	do.	do.	Skin.
5893	616	♂	.....	do.	June 15, 1899	do.	do.	do.
5899	1118	♂	.....	do.	.....	do.	do.	do.
5840	438	4547	♂	San José, L. Cal.	Feb. —, 1899	do.	do.	Skin and skull.
6004	.....	593	♀	do.	.....	do.	do.	Skin.
5899	597	♀	.....	Cape St. Lucas, L. Cal.	May —, 1899	do.	do.	do.
5897	369	♀	.....	do.	May —, 1899	do.	do.	do.
5899	.....	.....	.....	do.	May —, 1899	do.	do.	do.
5899	369	♀	.....	do.	May —, 1899	do.	do.	do.
5899	5445	♂	.....	San José, L. Cal.	Dec. 1, 1899	do.	do.	do.
671	.....	.....	.....	Mohave Desert, Cal.	.....	Lt. R. S. Williamson.	Dr. A. L. Hermann.	do.

## TAMIAS LATERALIS (Say) Allen.

## Say's Chipmunk.

- Sciurus lateralis* SAY, Long's Exped. ii, 1823, 46.—HARLAN, Faun. Amer. 1893, 181.—GODMAN, Am. Nat. Hist. ii, 1896, 144.—H. SMITH, Griffith's Cuvier's An. King. v, 1837, 355.—WAGNER, Schreber's Säuget. iv, pl. ccxiv, B.—FISCHER, Synop. Mam. 1899, 350.
- Arctomys (Spermophilus) lateralis* RICHARDSON, Zool. Journ. iii, 1828, 519; Fauna Bor.-Am. i, 1829, 174, pl. xiii.
- Spermophilus lateralis* "F. CUVIER'S Suppl. Buffon, i, Mam. i, 1831, 335".—WAGNER, Suppl. Schreber's Säuget. iii, 1843, 262.—BRANDT, Bull. Classe Physico-math. Acad. St. Pétersb. ii, 1844, 380.—AUDUBON & BACHMAN, Quad. N. Am. iii, 1853, 69, cxiv.—GIBBEL, Säuget. 1855, 638.—BAIRD, Mam. N. Am. 1857, 319, pl. xx, fig. 3 (head and feet); pl. xlv, fig. 5 (skull).—COOPER, Proc. Cal. Acad. iv, 1890, 4.—MERRIAM, U. S. Geol. Surv. Terr. 6th Ann. Rep. 1873, 664.
- Tamias lateralis* ALLEN, Proc. Bost. Soc. Nat. Hist. xvi, 1874, 290.—COUSE & YARROW, Wheeler's Expl. and Surv. West of 100th Merid. v, Zool. 119 (Apache, Arizona).—HENDSHAW, Ann. Rep. Chief Engineers for 1876, App. JJ, 1876, 311 (Southern California).

**SPECIFIC CHAR.**—Largest of the genus. Length of head and body 7.25 to 8.00; of tail to end of vertebrae about 3.25; to end of hairs 4.55. Above, yellowish-gray, with two broad stripes of white and four of black, which extend from the shoulders to the hips. No central dorsal line. Sides of neck and shoulders, and often the whole upper surface of the head, dark rufous or chestnut, varying greatly in intensity in different specimens; posterior edge of thighs and sides of rump also rufous, but paler than the sides of the neck and shoulders. Beneath, yellowish-white, the yellowish tint strongest on the breast. Eyelids white, with an indistinct pale ocular stripe. Tail above, blackish, varied with whitish and edged with pale yellowish; middle of the tail below, pale yellowish-brown, varying to reddish-cinnamon and chestnut, with a subterminal bar of black and yellowish-white edging.

The present species varies greatly in color, even among specimens from the same locality. The light stripes on the sides of the back range from nearly pure white to pale yellow; the black stripes by which they are enclosed, from pale brownish-black to intense black. Of the dark stripes, the outer is generally considerably broader than the inner; sometimes they are equal in width; the inner is occasionally entirely obsolete, and in about one-third of the specimens before me is less than one-fourth the width of the outer and much shorter, while in rare instances it is considerably wider than the outer. Occasionally the stripes are all only indistinctly indicated. The general color of the upper surface varies from whitish-gray to reddish-gray. In some specimens, the head and neck are scarcely more rufous than the back; in others, the upper surface of the head is much more strongly rufous than any other portion of the animal. To describe these variations more in detail:—No.

9820, from Yellowstone Lake (taken in July), is very strongly colored throughout. The whole upper surface and sides of the head and neck are bright reddish-brown, passing into brownish-yellow on the throat and breast. The light stripe on either side of the back is yellowish-white, the dark ones intense black, and of about the same width as the light stripe by which they are separated. The middle of the back is yellowish-gray; the sides of the body dull brownish-yellow; the lower parts are strongly yellowish, and the tail is edged with the same color. Another specimen (No. 2748, Coll. M. C. Z.), from Montgomery, Park County, Colo., is nearly as strongly rufous as the last, but the back of the neck is gray, like the back. The inner black dorsal stripes are obsolete; the outer is short and broad, and dull blackish instead of intense black, as in No. 9820. Several others, from the same locality, are very much paler; they show very little brownish on the sides of the neck and head; the light stripes are well defined and extend from the ears to the hips, but the black stripes are *wholly wanting* in one specimen (which has hence exactly the *pictura* of *T. harrisi*), and in others only the outer are present, and are reduced to a short dusky band. Generally, when the inner black stripe is wanting, the outer is double the width it usually has when both are present. Some specimens show no more rufous on the head than elsewhere, except over a small area on the forehead.

In this species, there seems to be very little variation in color with age, and I am unable to correlate any variations with differences of locality. Some of the most diverse examples were obtained at Montgomery, Colo., the series obtained there by myself in 1871 representing nearly the whole range of variation in the whole series.

*Tamias lateralis* is the largest species of the genus, and is easily distinguished by its coloration, especially by the *absence of a black dorsal line*. With this exception, it has essentially the pattern of coloration seen in *T. striatus* and *T. asiaticus*. The white stripes begin at the ears and terminate at the hips, but anterior to the shoulders they are often much obscured by a strong suffusion of rufous. In voice, habits, mode of life, pattern of coloration, and external features generally, *T. lateralis* is a true *Tamias*, differing from the other species mainly in the larger size of the first upper premolar. This tooth, however, is still much smaller than in the *Spermophilus*. The skull, however, is rather broader and deeper than in the other *Tamias*.

This species was first described by Say, in 1823, from specimens ob-

tained near the sources of the Arkansas River. Mr. Say properly regarded it as a Ground Squirrel, though describing it as a *Sciurus*. He says:—"It is allied to the *Sc. striatus*, and belongs to the same subgenus (*Tamias*, Illig.), but it is of larger size," etc., etc. Dr. Richardson, in his excellent account of the species, transferred it to *Spermophilus* (regarded by him as a subgenus of *Arctomys*), to which genus it was afterward uniformly referred 'till 1874, when I again placed it in *Tamias*.

Up to a comparatively recent date, this has been a rare species in collections. Professor Baird, in 1857, was able to refer to but two examples, and few others had been seen by other naturalists. In the preparation of the present article, I have had access to upward of seventy specimens, nearly all of which have been collected since 1868, and most of them under the auspices of the present Survey.

Its known range extends from Apache, Ariz. (*Coues* and *Yarrow*), northward in the Rocky Mountains to latitude 57°, where, according to Richardson, it was obtained fifty years ago by Mr. Drummond. As shown by the subjoined list of specimens, it has been met with by Dr. Elliott Coues in Northern Montana; by Dr. Hayden and Mr. W. S. Wood, in the Black Hills; by Mr. F. J. Huse, at Yellowstone Lake, Montana Territory; by Mr. C. H. Merriam, at Henry's Lake, Idaho; by Dr. J. S. Newberry and Capt. Charles Bendire, in Oregon; by Mr. J. Stevenson and others, in various parts of Colorado; by Messrs. Ridgway and Bischoff, in Nevada; and by Capt. J. H. Simpson's party, in the Sierra Nevada Mountains. Dr. J. G. Cooper also refers to it as "common" near the summits of the Sierra Nevada Mountains in latitude 36°, and Mr. H. W. Henshaw reports it as frequent in the mountains of Southern California. Dr. Coues has lately found it "very common" in the pine-belt of the mountains of Northern Colorado. It hence may be supposed to occur throughout the mountainous districts of the interior, from the Black Hills of Dakota westward to the Sierra Nevada and Cascade Ranges. It lives among rocks in wooded districts, and appears to be chiefly alpine in its distribution. Its habits closely resemble those of the Chipmunk (*T. striatus*) of the Eastern States, as was noticed by Mr. Say, and later by Dr. Newberry and other writers who have had the opportunity of observing it in life.

TABLE LXXIX.—Measurements of three skulls of TAMIAS LATERALIS.

Catalogue-number.	Locality.	Total length.	Greatest width.	Distance between orbits.	Earl bones, length.	Earl bones, width behind.	Earl bones, width below.	Upper incisors from front to molars.	Upper incisors from front to hinder margin of palate.	Upper incisors, height.	Upper incisors, width between external edges.	Upper incisors, length taken together.	Lower jaw, length.	Lower jaw, height.
13866	Colorado	1.75	1.13	0.42	0.40	0.17	0.38	0.40	0.47	0.35	0.50	0.32	1.97	0.47
13867	do	1.63	1.00	0.40	0.37	0.15	0.34	0.47	0.45	0.34	0.48	0.33	1.83	0.40
13868	do	1.63	1.00	0.40	0.35	0.15	0.30	0.45	0.45	0.34	0.46	0.30	1.80	0.47

TABLE LXXX.—Measurements of thirteen specimens of TAMIAS LATERALIS.

Catalogue-number.	Original number.	Locality.	Sex.	From tip of nose to—				Tail to end of—		Length of—		Height of ear.	Nature of specimen.
				Eye.	Nr.	Occiput.	Tail.	Vertebrae.	Ilia.	Fore feet.	Hind feet.		
11998	4616	Chief Mountain Lake, <sup>sp</sup>	♂	0.80	1.00	0.60	0.40	2.50	4.30	1.00	1.40	.....	Fresh.
9745	600	Park County, Colo	♂	0.85	1.05	1.75	0.40	2.00	3.00	1.00	1.30	.....	do.
9746	630	do	♀	0.97	1.70	1.97	0.40	2.35	3.00	1.05	1.65	.....	do.
9747	631	do	♀	0.90	1.05	1.98	0.40	2.35	4.25	1.05	1.60	.....	do.
9748	600	do	♂	0.90	1.40	1.95	0.45	2.50	4.30	0.95	1.55	.....	do.
9750	500	do	♀	0.93	1.75	2.00	0.60	.....	1.17	1.75	.....	do.	
		Fort Garland, Colo	♀	1.05	1.00	0.60	0.35	4.30	1.05	1.00	1.35	.....	Alcoholic.
	3	Twin Lakes, Colo	♂	0.75	1.00	1.75	0.35	3.30	4.00	1.00	1.35	.....	do.
	3	do	♀	0.75	1.00	1.65	0.40	3.75	1.05	1.00	1.40	.....	do.
	5	do	♂	0.70	1.00	1.60	0.35	3.75	1.05	1.00	1.35	.....	do.
	6	do	♂	0.70	1.00	1.60	0.40	4.00	1.07	1.00	1.35	.....	do.
	7	do	♀	0.75	1.00	1.60	0.35	4.40	1.03	1.00	1.35	.....	do.
11979		Upper Des Chutes, Oreg	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	Skin.

TABLE LXXXI.—List of specimens examined of TAMIAS LATERALIS.

Catalogue-number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
9578	.....	363	♀	Shayokwison Depot, W. T.	July 4, 1890	A. Campbell	Dr. C. B. R. Kennerly	Skin.
9747	.....	.....	.....	Siwikamoon, W. T.	.....	do	do	do.
1978	.....	.....	.....	Upper Des Chutes, Oreg. Ter	Sept. 24, 1890	La R. S. Williamson	Dr. J. S. Newberry	do.
9249	.....	.....	.....	Fort Massachusetts, N. Mex	.....	Dr. D. C. Peters	Dr. D. C. Peters	do.
9300	.....	.....	.....	Carson City, Nev.	Mar. —, 1890	Clarence King	R. Ridgway	do.
11676	.....	350	.....	Fort Garland, Colo	June —, 1873	La G. M. Wheeler	H. W. Henshaw	do.
11698	.....	175	.....	Dayton, Colo	Aug. —, 1873	do	Dr. J. T. Rothrock	do.
11699	.....	175	.....	do	Aug. —, 1873	do	do	do.
11690	.....	360	.....	Twin Lakes, Colo	Aug. —, 1873	do	do	do.
3006	.....	73	.....	Sterio Nevada Mountains	June 16, 1890	Capt. J. H. Simpson	C. S. McCauley	do.

TABLE LXXXI.—List of specimens examined of *TAMIAS LATERALIS*—Continued

Catalogue number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
9319	.....	231	♂	Humboldt Mountains, Nev.	Sept. —, 1880	Clarence King	R. Ridgway	Skin.
11149	.....	.....	.....	Nevada	June 30, 1873	Lt. G. M. Wheeler	F. Biscoff	do.
11988	.....	4516	♂	Chief Mt. Lake, Mont. Ter.	Aug. 19, 1874	A. Campbell	Dr. E. Coues	do.
3055	.....	304	♂	Black Hills, Dak. Ter.	July 31, 1898	.....	W. S. Wood	do.
1911	.....	221	♂	Medicine Bow Creek	Aug. 7, 1896	.....	.....	do.
11495	.....	.....	.....	Colorado	.....	Dr. F. V. Hayden	J. H. Betsy	do.
11487	13996	.....	.....	do.	.....	do.	do.	Skin and skull.
11488	13967	.....	.....	do.	.....	do.	do.	do.
11430	13906	.....	.....	do.	.....	do.	do.	do.
11489	.....	.....	.....	do.	.....	do.	do.	Skin.
42-4	.....	44	.....	Black Hills	June 1, 1837	Lt. G. K. Warren	Dr. F. V. Hayden	do.
9825	.....	96	.....	Yellowstone Lake	July —, 1871	Dr. F. V. Hayden	F. J. Huse	do.
9836	.....	98	.....	do.	July —, 1871	do.	do.	do.
9890	.....	93	.....	do.	July —, 1871	do.	do.	do.
11103	.....	96	.....	Henry's Lake, Idaho	Aug. 10, 1873	do.	C. H. Merriam	do.
9571	.....	.....	.....	Idaho City, Colo.	July 17, 1899	do.	J. Stevenson	do.
9578	.....	.....	.....	do.	July 16, 1899	do.	do.	do.
9573	.....	.....	.....	do.	July 16, 1899	do.	do.	do.
9574	.....	.....	.....	do.	July 16, 1899	do.	do.	do.
9575	.....	.....	.....	do.	July 16, 1899	do.	do.	do.
9576	.....	.....	.....	do.	July 16, 1899	do.	do.	do.
9577	.....	.....	.....	Near Berthoud's Pass, Colo.	July 27, 1899	do.	do.	do.
9579	.....	.....	.....	do.	July 27, 1899	do.	do.	do.
9580	.....	.....	.....	do.	July 27, 1899	do.	do.	do.
9581	.....	.....	.....	do.	July 27, 1899	do.	do.	do.
9582	.....	.....	.....	do.	July 27, 1899	do.	do.	do.
9583	.....	.....	.....	do.	July 27, 1899	do.	do.	do.
9584	.....	.....	.....	Idaho City, Colo.	July 17, 1899	do.	do.	do.
9578	.....	.....	.....	do.	July 17, 1899	do.	do.	do.
9585	.....	.....	.....	do.	July 17, 1899	do.	do.	do.
9586	.....	.....	.....	do.	July 16, 1899	do.	do.	do.
9587	.....	.....	.....	do.	July 16, 1899	do.	do.	do.
9588	.....	.....	.....	do.	July 16, 1899	do.	do.	do.
9589	.....	.....	.....	do.	July 16, 1899	do.	do.	do.
9590	.....	.....	.....	do.	July 17, 1899	do.	do.	do.
9591	.....	.....	.....	do.	July 16, 1899	do.	do.	do.
9592	.....	.....	.....	do.	July 16, 1899	do.	do.	do.
9593	.....	.....	.....	do.	July 17, 1899	do.	do.	do.
9594	.....	.....	.....	do.	July 17, 1899	do.	do.	do.
9595	.....	.....	.....	do.	July 16, 1899	do.	do.	do.
9596	.....	.....	.....	do.	July 16, 1899	do.	do.	do.
9597	.....	.....	.....	do.	July 16, 1899	do.	do.	do.
9598	.....	.....	.....	do.	July 16, 1899	do.	do.	do.
9599	.....	.....	.....	do.	July 16, 1897	do.	do.	do.
9600	.....	.....	.....	do.	July 23, 1873	Lt. G. M. Wheeler	Dr. J. T. Rothrock	Alcoholic
.....	.....	3	.....	do.	Aug. —, 1873	do.	do.	do.
.....	.....	5	.....	do.	July 18, 1873	do.	do.	do.
.....	.....	6	.....	do.	July 18, 1873	do.	do.	do.
.....	.....	7	.....	do.	July 18, 1873	do.	do.	do.
9743	609	.....	.....	Park County, Colo.	July 3, 1871	Rocky Mountain Expedition.	Allen, Bennett, and Blinn	Skin.
9746	630	.....	.....	do.	July 3, 1871	do.	do.	do.

\* In Museum of Comparative Zoology, Cambridge, Mass.



TABLE LXXXI.—List of specimens examined of *TAMIAS LATERALIS*—Continued.

Catalogue number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
*2747	.....	631	.....	Park County, Colo .....	July 8, 1871	Rocky Mountain Expedition.	Allen, Bennett, and Miles.	Skin.
*2748	.....	838	.....	do .....	July 20, 1871	do .....	do .....	do.
*2749	.....	965	.....	do .....	July 20, 1871	do .....	do .....	do.
*2750	.....	969	.....	do .....	July 20, 1871	do .....	do .....	do.
*2751	.....	1006	.....	El Paso County, Colo .....	July 20, 1871	do .....	do .....	do.
*3317	.....	.....	.....	Bear Creek, Oreg .....	Aug. 21, 1876	Capt Chas. Bendire.	Capt Chas. Bendire.	do.

\* In Museum of Comparative Zoology, Cambridge, Mass.

## GENUS SPERMOPHILUS F. Cuv.

*Spermophilus* F. CUVIER, Mém. du Mus. ix, 1823, 293; Dents des Mamm. 1825, 161, 255, pl. iv (type "*Mus citellus*, Linn.").*Spermophilus* RICHARDSON, Parry's Second Voyage, App. 1825, 313 (= *Spermophilus* F. Cuv.).*Spermophilus* WAGLER, Syst. Avium, 1830, 22 (accredited to F. Cuvier).*Citellus* LICHTENSTEIN, Darst. neuer oder wenig bekannt. Säuget. 1837-34 [1830?], pl. xxxi, fig. 2 (not paged).*Colobitis* BRANDT, Bull. Classe Physico-math. de l'Acad. Imp. des Sci. de St. Pétersb. ii, 1844, 360.*Otocolobus* BRANDT, Bull. Classe Physico-math. de l'Acad. Imp. des Sci. de St. Pétersb. ii, 1844, 369 (= *Colobitis*).*Otospermophilus* BRANDT, Bull. Classe Physico-math. de l'Acad. Imp. des Sci. de St. Pétersb. ii, 1844, 370.

**GENERIC CHAR.**—Skull very variable in form, being either narrow and elongate or short and broad, with the dorsal outline moderately or strongly convex, and the zygomatic arches greatly or only moderately expanded; post-orbital processes generally triangular, strong, and directed downward; zygomatic processes of the maxillary greatly depressed and expanded; plane of the malar turned outward, sometimes anteriorly nearly horizontally flattened; zygomatic arches spreading; position of the anteorbital foramina more forward than in *Tamias*, subtriangular, with a strongly developed tubercle at the outer lower corner; upper premolars always two, the first variable in size, generally much larger than in *Sciurus* or *Tamias*, and sometimes nearly as large as in *Cynomys*; grinding-teeth variable in strength and size; cheek-pouches well developed; body slender or thick-set; tail long, moderate, or short, cylindrical or flattened; ears large, of medium size, or rudimentary, never tufted; nail of pollex generally undeveloped; character of the pelage and pattern of coloration variable.

As previously stated, the genus *Spermophilus*, as commonly recognized,



is a heterogeneous group, embracing quite diverse species, some of which strongly approach *Sciurus*, while others foreshadow *Cynomys*, and others still grade by almost insensible stages into *Tamias*. The group was first dismembered\* by Brandt in 1844, who divided it into two "subgenera", namely, *Colobotis* (also written later in the same paper "*Otolobus*") and *Otospermophilus*. To the first he referred all the Old World species known to him, and also three of the North American species; the latter is exclusively American. These two groups are based on slight peculiarities of dentition (particularly in respect to the size and form of the first upper premolar), the size of the ear, and the length of the tail. The Old World species of *Colobotis* are all short-tailed, with small or rudimentary ears, the tail with the hairs exceeding a length of two inches in only one species (*S. evermanni*), being generally considerably less than one-fourth of the length of the head and body. Only one (*S. richardsoni*) of the three American species referred by Brandt to this group really belongs here, the others (*S. "hoodi"* = *tridecemlineatus*, and *S. franklini*) having few characters in common with the others. *Otospermophilus* is a much more natural division, but was made to include *S. mexicanus*, which, as will be shown later, belongs to a wholly different division. The other species referred to *Otospermophilus* were *S. grammurus* (with its varieties and synonyms) and *S. lateralis*; the affinities of the last named are divided between this group and *Tamias*, with a preponderance toward the latter. Brandt divided the Old World representatives of *Colobotis* into three sections ("A", "B", and "C"), based wholly on the seasonal and valueless character of the pilosity of the soles, which he appears to have supposed to be a constant character in adults. His section "B" (consisting of *S. evermanni* and *S. parryi*) he says resembles *Otospermophilus* in the length and structure of the tail. This is also true of other characters; it hence forms a natural and well-marked subdivision of his subgenus *Colobotis*.

In 1855, Brandt's divisions and subdivisions were adopted by Giebel. Baird, in 1857, while pointing out the worthlessness of any distinctions based on the pilosity of the soles, thought Brandt's subgenus *Otospermophilus* entitled to permanent recognition, and adopted it with merely the removal therefrom of *S. mexicanus* to *Colobotis*, under which latter group Professor Baird

\* Lichtenstein, however, about 1830, proposed the name *Citellus* for certain species, but without giving for the group any tangible diagnosis. The first species described under this name was *S. montanus*, but he also described two Old World species (*C. felinus* and *C. magosericus*) that differ widely from *S. mexicanus*, belonging in fact to an entirely different section of the genus. Brandt makes, and quite properly, as it seems to me, *Citellus* merely a synonym of *Spermophilus*.

arranged all the other American *Spermophili*. He also recognized the highly Sciurine character of the *Otospermophili*, which he regarded as "only distinguishable externally by the cheek-pouches" from the true Squirrels. *Colobotis*, however, as thus left, embraced very diverse types.

While, as already stated, it is impossible to subdivide the American *Spermophili* into sharply definable groups, they admit of arrangement in three sections, of which the extreme phases of differentiation are as wide asunder as are most allied modern genera, but which still thoroughly inosculate through variously intermediate specific forms. If their most differentiated specific representatives stood alone, even the *generic* distinctness of these groups would be unquestioned. As already intimated, one of these deviating lines is in the direction of *Cynomys*, another in the direction of *Tamias*, and the third tends strongly toward *Sciurus*. Provisionally recognizing these sections as subgenera, they may be characterized as follows:—

Subgenus OTOSPERMOPHILUS Brandt (emend.).

Ears large, high, pointed (larger and more pointed than in some species of *Sciurus*); tail long, full, and broad, with the hairs two-thirds to three-fourths the length of the head and body; general form of the skull, and the dentition, strongly Sciurine. Species, *S. grammurus*, *S. annulatus*.

Subgenus COLOBOTIS Brandt (emend.).

Ears small, sometimes marginiform; tail short, flattened, with the hairs one-third to one-half the length of the body; skull short and broad, the zygomatic arches broad, generally greatly widened posteriorly; dentition heavy, and the first upper premolar generally large. Species, *S. richardsoni*, *S. empetra*, *S. mollis*, *S. epilogoma*, *S. oboletus*.

Subgenus ICTIDOMYS \* nob.

Ears generally small, sometimes rudimentary; tail long, cylindrical, or narrow and flattened, or quite broad, with the hairs one-half to three-fourths the length of the body; skull very long and narrow; first upper premolar usually rather small, and the dentition not heavy. Species, *S. leucogaster*, *S. maculatus*, *S. tridactylus*, *S. franklini*.

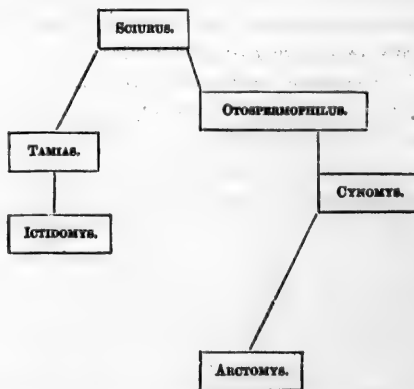
In *Otospermophilus*, the first upper premolar is scarcely larger than in some species of *Sciurus*; the skull is similarly arched and expanded; the anteorbital foramina are narrower, and their outer walls are thinner than in the other Spermophiles. The cranial differences relate mainly to the greater obliquity of the malar bone and the greater lateral expansion of the zygomatic processes of the maxillaries. *S. empetra* (= *parryi* of authors) is but a little way removed from the group, and forms an easy passage to *Colobotis*.

In *Colobotis*, the skull is shorter and broader, generally much arched, the zygomatic arches more spreading, and the dentition heavier; in all these characters, as well as in the short flat tail and the thick-set form, the group

\* ETYM.—*ictis* = weasel, and *mys* = mouse; in allusion to the slender Musteline form of most of the species.

approaches *Cynomys*. While *S. empetra* deviates toward *Otospermophilus*, *S. richardsoni* strongly approaches *Cynomys*, as do *S. spilosoma* and *S. obsoletus* to *Ictidomys*, especially in the general contour of the skull. In *Ictidomys*, there is an approach, through *S. mexicanus*, toward *Tamias*, while *S. franklini*, in its full, broad, and rather long tail and prominent ears, and somewhat in the general shape of the skull and rather small first upper premolar, rather inclines toward *Otospermophilus*.

As is evident from the foregoing remarks, the complex inosculation of *Sciurus*, *Tamias*, *Cynomys*, and the several divisions of *Spermophilus*, render it impossible to arrange them serially in a single line. The following diagrammatic disposition to some extent expresses their mutual affinities, as well as their relationship to *Arctomys*.



The absence of any broad gaps among the many species composing the above-named groups leads to the inference of their comparatively recent divergence from some common ancestral type, which may or may not have been something nearer *Arctomys* than *Sciurus*, or something quite different from either. The extinct species of the Tertiary formations,\* of which there are indications of a large number, none of which, unfortunately, are as yet well known, were mainly of large size, most of them exceeding the existing species of *Cynomys*, while some equalled and even exceeded the largest species

\* For an account of these, see the concluding portions of this memoir.

of *Arctomys*. As far as can be judged from the characters afforded by the few mandibular rami, from which as yet they are in the main only known, they more resembled, at least in dentition, the existing species of *Arctomys* and *Sciurus* than those of *Cynomys*, or the heavier-toothed forms of *Spermophilus*.

As regards their present distribution, the *Spermophili* are confined mainly to the colder portions of the northern hemisphere, and are numerous and about equally represented in North America and the colder parts of the Old World. All the Old World forms, with one exception (*S. evermanni* of North-eastern Asia), are short-tailed forms, while the American species, with two or three exceptions, are long-tailed, and approach more nearly to *Sciurus* and *Tamias* than do those of the Old World. Several of the species range as far westward as Central Europe, and are more or less numerous thence eastward to the eastern shores of Northern Asia. In North America, none occur east of the plains and prairies of the central portion of the continent, ranging thence westward to the Pacific coast. The genus has representatives from the shores of the Arctic coast southward to the plains of Northern Mexico. All of the known species, except one, have representatives within the United States, this being the *S. annulatus*, known as yet from a single specimen (of which the locality is authentic) from Colima, Western Mexico. Another, however (*S. empetra*), only just reaches our northwestern border, while no less than three (*S. mexicanus*, *S. spilzoma*, and *S. grammurus*) are known to occur considerably beyond the northern boundary of Mexico. Only about one-fourth of the whole number of species are found at any one locality.

It may be further noted that the pelage of all of the southern species consists of rather coarse, harsh, stiff hairs, generally flattened and grooved on the outer surface, with very little or no under fur, especially in summer; while all the northern and alpine species, with one exception (*S. franklini*), have a soft, thick, furry pelage, with abundant under fur. In respect to geographical variation, there is, as a rule, a decided decline in size southward in individuals of the same species, with quite often an appreciable increase in the size of the ears. In respect to seasonal variations, the pelage is everywhere softer and heavier toward winter, with the soles quite fully clothed, while in summer they are generally more or less naked. All the northern species are known to pass the colder portion of the year in a state of hibernation. Southward, the period of hibernation is of course much shorter, while the most southern forms continue more or less active throughout the winter.

Several of the species are remarkable among our North American Rodentia for their carnivorous propensities. This has been especially noted by Dr. P. R. Hoy in the case of *S. tridecemlineatus*, who has made the habits of this animal the subject of careful study.\* He has not only observed the destruction of mice and small squirrels by them while in a state of confinement, but has convinced himself that they are a useful check upon the increase of the different species of *Arvicola* and other field-mice, and says that Ground Squirrels cannot inhabit the same locality. He says;—"When a Squirrel or other small animal is put into a cage with one of these [Spermophiles], it will, in a moment, be all animation and activity, darting at the intruder, inflicting a wound and flying back with such rapidity as to leave but little chance for defence. As soon as it has disabled its antagonist, it seizes it by the back of the neck and instantly kills it. During these combats, the Gopher utters a low snarling growl, and emits a Musteline odor. After killing, they remove the upper part of the skull, suck the blood, and eat out the brains. The carcass is then devoured as occasion requires; but if an abundant supply is at hand, they only eat the brains, resembling in this respect the Weasel." He adds,—"I am satisfied that when the case of 'Ben-fits versus Injuries' is properly investigated, the agricultural interests will promptly decide that the 'Striped Spermophile' is an advantage to the country, and is deserving of protection rather than destruction from the hands of the farmer. They keep in check the Meadow Mice (*Arvicola*) and other small quadrupeds." He further suggests that it might possibly prove useful in exterminating the Pouched Gopher (*Geomys bursarius*). Mr. Kennicott adds that Dr. Hoy had informed him that he had found the skins of Meadow Mice in the burrows of this animal.

Mr. Kennicott states further, that the Gray Spermophile (*S. franklini*) is also to some extent carnivorous, and that he had heard farmers complain of their destroying young chickens.† I have also been informed by Mr. S. Jillson, of Tuckerton, N. J., that the small colony of these animals that have recently become, by accident, established in that neighborhood, destroy young chickens and turkeys. Dr. Coues‡ has recorded that *S. richardsoni* feeds largely upon the carcasses of buffalo. Mr. H. W. Henshaw also states that

\* See U. S. Patent Office Report, Agricultural, for 1863, pp. 68-70.

† U. S. Patent Office Report, Agricultural, for 1866, p. 80.

‡ American Naturalist, ix, Mar. 1875, p. 173.

*S. grammurus* is well known to the residents about Camp Bowie, Ariz., "for its depredations on the hen-coops, its aim being the eggs, which it was often successful in carrying off".\*

SYNOPSIS OF THE SUBGENERA, SPECIES, AND VARIETIES OF SPERMOPHILUS.

- I. Form Sciurine; skull broad inter- and anteorbitally; first upper premolar small, less or not more than one-fourth the size of the second; molars relatively small; edge of outer wall of the anteorbital foramina not thickened; coronoid processes of lower jaw long and slender; ears very large; tail long, full, and bushy (two-thirds of the length of head and body)..... OTOSPERMOPHILUS.
1. Body finely mottled above with yellowish-brown and black; beneath pale yellowish-brown; tail below yellowish-brown, with three longitudinal bands of black, less distinct above. Runs occasionally into melanistic phases..... GRAMMURUS.
- a. General color above mixed black and white, rather lighter on the anterior half of the dorsal surface, and more brownish posteriorly; not distinctly whiter on the sides of the shoulders, nor darker medially on the nape and anterior portion of the back. Habitat, Colorado, southward into Mexico, and westward to the Sierra Nevada Mountains..... var. *grammurus*.
- b. An indistinct broad hoary or grayish-white band on the sides, extending from the head to beyond the shoulders, and sometimes reaching the hips, narrowing posteriorly, broad anteriorly, and sometimes nearly meeting above on the nape. Habitat, Southern California..... var. *beckeyi*.
- c. Similar to the last, but with the hoary patches separated on the nape and over the shoulders by a band of dark brown, varying to nearly black. Habitat, Northern California and Western Oregon..... var. *douglasii*.
- II. Skull abruptly narrowed interorbitally; zygomatic arches heavy and spreading, transversely flattened; muzzle narrow; first premolar large, about one-third to one-half the size of the second; tail generally narrow and short, with the hairs one-fourth to one-third the length of the head and body; form rather thick and stout; ears small, often a mere rim, nearly concealed by the pelage..... COLOBOTIS.
2. Size large; above mixed black, white, and yellowish-brown, the white chiefly in crowded subquadrate spots; upper surface of the head chestnut; beneath rusty-white; tail rather short, but full and bushy; ears quite small..... EMPETRA.
- a. Strongly rufous below and on the sides; back varied with black, brown, and white. Habitat, Barren Grounds of Arctic America..... var. *empetra*.
- b. Above gray; sides and beneath gray, generally with very little or no fulvous; tail shorter and more bushy. Habitat, Kodiak Island (and Peninsula of Alaska?)...... var. *kodiacensis*.
- c. Smaller and darker, the light spots more fulvous, and the tail and ears relatively longer. Habitat, British Columbia, southward into Washington Territory..... var. *erythroglauca*.
3. Smaller; above pale yellowish-brown, varying to pale rufous, mixed more or less with black, with generally an indistinct mottling of yellowish-gray..... RICHARDSONI.
- a. Above light yellowish-brown, varied with dusky, and generally faintly mottled with very small indistinct light spots; tail gray above, varied with black, brownish-yellow below, with a partly concealed bar of black near the end, and edged both above and below with yellowish-white. Habitat, Plains of the Saskatchewan, southward to Northern Dakota..... var. *richardsoni*.
- b. Smaller than the last, with larger ears, and much darker coloration; tail mostly black above, edged with white; below with a broad subterminal bar of black, and another narrower basal one. Habitat, northern portion of the United States, from Dakota westward to the Plains of the Columbia, southward to the Laramie Plains, northward into British Columbia..... var. *townsendi*.
4. Size small; ears obsolete; tail very short; above finely and uniformly variegated pale yellowish-brown and dusky, without spots; below gray, faintly washed with creamy-yellow. Habitat, Northern Utah and westward..... MOLLIS.

\* Rep. Wheeler's Expl. and Surv. West of the 100th Merid. vol. v, No. 1. p. 132.



5. Size small; above strongly reddish-brown, with indistinct subquadrate spots of reddish-white, not arranged in rows; tail very narrow, about half the length of the head and body; below reddish-brown, with an indistinct narrow line of black; ears very small, almost obsolete. Habitat, Southern New Mexico, Southwestern Texas, and Eastern Mexico. . . . . *APLOSONOMA*.
6. In size and general form similar to the last; above dull yellowish-brown, indistinctly spotted with lighter. Habitat, from the Black Hills and Fort Kearney westward to the Great Basin. . . . . *OBSOLEUTUS*.
- III. Skull very long and narrow, the nasal portion relatively broad and very long; zygomatic arches rather weak, not widely spreading; first upper premolar of medium size, about one-third as large as the second; tail quite long, the vertebrae alone nearly two-thirds to more than two-thirds the length of the head and body; ears small; general form of the body long and slender. . . . . *ICTIDOMYS*.
7. Above yellowish-brown, finely varied with gray; below yellowish-white; tail cylindrical, concolor with the body; ears nearly obsolete. Habitat, vicinity of Fort Yuma, Southern California. . . . . *THRETIKAUDUS*.
8. Above dark reddish-brown, inclining to olivaceous, with subquadrate spots of white rather regularly arranged in nine to eleven rows; tail about two-thirds the length of the body; beneath dull brownish-yellow, with a band of black. Habitat, Southern New Mexico, Southwestern Texas, and southward into Mexico (to Vera Cruz?). . . . . *MEXICANUS*.
9. Larger; above dark brown, mixed with reddish, varying to pale brown and blackish-brown, with six to eight light continuous lines, alternating with five to seven rows of light spots; tail generally about two-thirds of the length of head and body, rather narrow; below yellowish-brown centrally and edged with yellowish, between which is a very broad band of black. . . . . *TRIDECIMLINEATUS*.
- a. Darker above; the light lines rather narrow. Habitat, the prairies of the United States northward to the Saskatchewan. . . . . *var. tridecimlineatus*.
- b. General color much paler, with the light lines and spots broader. Habitat, the dry plains and deserts westward to the Great Basin. . . . . *var. pallidus*.
10. Large; above yellowish-brown, varied with black, the light and dark markings forming indistinct subquadrate spots; head grayer; tail two-thirds the length of the head and body, rather full and bushy, whitish, with three bands of black; ears small, but distinct. Habitat, Northern Illinois and Missouri, northward to latitude 64°. . . . . *FRANKLINI*.
- Incerta sedis.*
11. (Cranial characters unknown.) Size medium; ears large; tail with hairs nearly as long as the body; form highly Scurine; above varied yellowish-brown and black; sides of neck and shoulders and outer side of limbs strongly reddish-brown; beneath yellowish, the color of the dorsal surface nearly meeting on the middle of the ventral surface; tail above marked with broad transverse bars of black, alternating with narrower bars of brownish-yellow; lower surface strongly reddish-yellow. Habitat, Plains of Colima, Western Mexico. . . . . *ANNULATUS*.

### SPERMOPHILUS GRAMMURUS (Say) Bachman.

#### Lined-tailed Spermophile.

#### Var. GRAMMURUS.

#### Rocky Mountain Lined-tailed Spermophile.

- Spermophilus grammurus* SAY, Long's Exped. to the Rocky Mts. ii, 1893, 72.—HALLAM, Penn. Amer. 1895, 162.—GODMAN, Amer. Nat. Hist. ii, 1893, 136.—H. SMITH, Griffith's Cuvier's An. King. v, 1897, 255.—FISCHER, Synop. Mam. 1899, 350.
- Spermophilus grammurus* BACHMAN, Charlesworth's Mag. Nat. Hist. iii, 1890, 300.—WAGNER, Suppl. Schreber's Säuget. ii, 1843, 253.—BRANDT, Bull. Classe Physico-math. Acad. Imp. Sci. St. Pétersb. ii, 1844, 390.—SCHINZ, Syn. Mam. ii, 1845, 74.—BAIRD, Proc. Acad. Nat. Sci. Phila. 1856, 334; Mam. N. Amer. 1857, 310, pl. iv, animal; U. S. and Mex. Bound. Surv. ii, pt. ii, 1860, 38.—COUES, Amer. Nat. i, 1867, 360; Proc. Acad. Nat. Sci. Phila. 1867, 135.—MERRIAM, U. S. Geol. Surv. Terr. 6th Ann. Rep. 1873, 663.—ALLEN, Bull. Essex Inst. vi, 1874, 66.—COUES & YARROW, Rep. Expl. and Surv. West of 100th Merid. v, Zool. 1875, 131.

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- Spermophilus grammurus* var. *grammurus* ALLEN, Proc. Bost. Soc. Nat. Hist. xvi, 1874, 293.  
*Spermophilus couchii* BAIRD, Proc. Acad. Nat. Sci. Phila. 1856, 332; Mam. N. Amer. 1857, 311, pl. lxxxi, fig. 3, skull (melanistic form).  
*Spermophilus buckleyi* BLACK, Proc. Acad. Nat. Sci. Phila. 1861, 314 (melanistic form).

## Var. BEECHLEY.

### Californian Lined-tailed Spermophile; Californian "Ground Squirrel".

- Arctomys* (*Spermophilus*) *beecheyi* RICHARDSON, Fauna Bor.-Amer. i, 1829, 170, pl. xii, B; Zool. Beechey's Voyage, Mam. 1839, 8.  
*Arctomys beecheyi* WAGNER, Suppl. Schreber's Säuget. pl. cxx, E.  
*Spermophilus beecheyi* "F. CUVIER, Suppl. Buffon, i, Mam. 1831, 331".—BRANDT, Bull. Classe Physico-math. Acad. Imp. Sci. St. Pétersb. ii, 1844, 390.—SCHINE, Syn. Mam. ii, 1845, 67.—BAIRD, Proc. Acad. Nat. Sci. Phila. 1856, 334; Mam. N. Amer. 1857, 307, pl. iii, fig. 2, animal; pl. xivi, fig. 3, skull.—COOPER, Nat. Hist. Wash. Terr. pt. iii, 1859, 81.—COOPER, Amer. Nat. iii, 1869, 183.—BUCKLEY & GIBBS, Nat. Hist. Wash. Terr. pt. iii, 1869, 129 (Northern California).—COUES, Amer. Nat. i, 1867, 359 (habits); Proc. Acad. Nat. Sci. Phila. 1867, 134.—HENSCHAW, Ann. Rep. Chf. Engineers for 1876, App. JJ, 1876, 311.  
*Spermophilus grammurus* var. *beecheyi* ALLEN, Proc. Bost. Soc. Nat. Hist. xvi, 1874, 293.  
*Spermophilus macrurus* BENNETT, Proc. Zool. Soc. Lond. i, 1833, 41 (melanistic phase).—WAGNER, Suppl. Schreber's Säuget. iii, 1843, 245 (compiled).—BRANDT, Bull. Classe Physico-math. Acad. Imp. Sci. St. Pétersb. ii, 1844, 390 (compiled).—SCHINE, Syn. Mam. ii, 1845, 67 (compiled).—AUDUBON & BACHMAN, Quad. N. Amer. iii, 1853, 181, pl. cxxxix (compiled).  
*Solurus* (*Macrotus*) *californicus* LESSON, Descr. de Mam. et d'Ois. Nouv. 1847, 143.—(See also BAIRD, Mam. N. Amer. 1857, 230.)

## Var. DOUGLASSI.

### Douglas's Lined-tailed Spermophile; Oregon "Ground Squirrel".

- Arctomys*? (*Spermophilus*?) *douglasi* RICHARDSON, Fauna Bor.-Amer. i, 1829, 172; Zool. Beechey's Voy. Mam. 1839, 8.  
*Spermophilus douglasi* "F. CUVIER, Suppl. Buffon, i, Mam. 1831, 333".—WAGNER, Suppl. Schreber's Säuget. iii, 1843, 247.—BRANDT, Bull. Classe Physico-math. Acad. Imp. Sci. St. Pétersb. ii, 1844, 390.—SCHINE, Syn. Mam. ii, 1845, 69.—AUDUBON & BACHMAN, Quad. N. Amer. i, 1846, 373, pl. xlix.—BAIRD, Mam. N. Amer. 1857, 309, pl. xlv, fig. 1, skull.—BUCKLEY, Nat. Hist. Wash. Terr. pt. iii, 1859, 96.—BUCKLEY & GIBBS, Nat. Hist. Wash. Terr. pt. iii, 1869, 129.  
*Spermophilus grammurus* var. *douglasi* ALLEN, Proc. Bost. Soc. Nat. Hist. xvi, 1874, 293.

## Var. GRAMMURUS.

### Rocky Mountain Lined-tailed Spermophile.

VARIETAL CHARs.—Length of head and body about 12.00; of tail to end of vertebrae about 8.00; to end of hairs 9.00. Above, coarsely mottled with white or brownish-white and black, giving the general effect of gray; generally, the gray is purest anteriorly, where the light and dark tints are in strong contrast; the posterior half of the dorsal surface generally more or less strongly washed with brown, where the white is partly or wholly replaced by yellowish-brown and the black by dark brown. The hairs are black at the base and tip, with a broad subterminal zone of whitish, which, in different specimens, varies from pure white to reddish-brown. Feet gray. The gray is also purer on the sides of the body and neck. Below, pale yellowish-



white, becoming brownish-white on the inside of the limbs; hairs all dark basally. Eyelids white, forming a conspicuous light eye-ring. Ears internally and posteriorly brownish-yellow; anteriorly dark brown, varying to black. Tail white and black in alternating longitudinal bands of nearly equal width—two black and three white. The hairs individually are white at the tips, with two broad bands of black separated by white; the extreme base is often also black, but usually white. Occasionally presents melanistic phases of coloration.

**HABITAT.**—Colorado and Western Texas, southward into Mexico, and westward to the Sierra Nevada Mountains.

General form much as in the true Squirrels (*Sciurus*). Ears high and broad, as large as in most species of *Sciurus*. Tail full and bushy, distichous; the hairs two to two and a half inches long, giving a breadth to the tail, when the hairs are outstretched, of four to five inches. Palms and soles (generally) wholly naked. Claws rather short for a *Spermophile*, yet decidedly fossorial rather than *Sciurine*. Pelage coarse but not rigid; under fur sparse, especially in summer. The hairs, when magnified, are seen to be flattened, with the outer surface grooved.

Different individuals vary greatly in coloration, the color of the upper surface ranging from nearly pure gray (especially anteriorly) to strong reddish-brown, while that of the lower surface varies from pale yellowish-white to reddish-brown. The gray is generally purest over the shoulders, but is frequently developed on the sides of the neck and shoulders, with the intervening dorsal space either darker or more suffused with rufous. There is thus an approach to the distinct gray longitudinal bands seen in vars. *beecheyi* and *douglasi*. In several specimens from Soda Springs, Colo. (as in Nos. 9565, 9562, and 9563), and in others from Ogden and Provo, Utah (as in Nos. 11133, 11135, and 11147), the gray forms a continuous mantle, covering the whole anterior half of the dorsal surface, sharply bounded behind by the reddish-brown of the posterior half of the back. In others, the gray blends gradually into the brownish. In some of the Soda Springs and Ogden specimens, the white so predominates over the black as to form a white ground-color minutely grizzled with black. In some, the gray mantle is more or less distinctly divided by a mesial space of brownish, thus showing a complete resemblance to var. *beecheyi*. Occasionally, as especially in several specimens collected by Mr. Henshaw in Arizona, the surface of the pelage

becomes worn off on the posterior part of the back, leaving exposed the dull brownish under fur. In consequence of the wearing-off of the ends of the hairs, the natural surface-markings wholly disappear, and give place to a uniform tint of faded dingy-brown.

As shown by the appended measurements of the skulls of this variety, the largest specimens come from the mountains of New Mexico.

Var. BEECHEYI.

*Beechey's Sperophile; Californian "Ground Squirrel".*

VARIETAL CHARs.—Rather smaller than var. *grammurus*; similar in form and general details of structure, differing mainly in coloration, the gray mantle being divided mesially by a rather wedge-shaped, broad area of brownish. The gray is thus limited to two broad bands on the sides of the neck and shoulders, extending from the occiput to the posterior edge of the scapulae, or even beyond the middle of the body. The dark area by which they are separated is narrow at the nape and slowly widens posteriorly. These lateral bands of gray are sometimes quite narrow, sometimes very wide, nearly meeting along the dorsal line over the scapular region. Through such specimens, a complete intergradation may be traced into the mantled form of var. *grammurus*. No. 3621, from Fort Tejon, has the gray of the mantle strongest on the nape, with no indication of a division, and is, in this respect, precisely like No. 9568 from Soda Springs, Colo. Except in respect to the quite constant feature of the more intense gray of the sides of the shoulders, separated mesially by brown, the coloration of var. *beecheyi* is like that of var. *grammurus*, with parallel variations in respect to the depth and relative proportions of the prevailing tints.

HABITAT.—West of the Sierra Nevada Mountains, from Northern California southward into Mexico.

In respect to size, fifteen skulls of var. *beecheyi* give an average length of 2.20 against an average length of 2.40 in nine skulls of var. *grammurus*. The largest skulls of var. *beecheyi* overlap the smaller of var. *grammurus*. In all the details of structure, the skulls of the two forms are indistinguishable.

Var. DOUGLASSI.

*Douglass's Sperophile.*

VARIETAL CHARs.—Intermediate in size between vars. *grammurus* and *beecheyi*. Differs from *beecheyi*, in color, in the mesial space between the

gray shoulder-patches being darker,—black instead of brown. This space varies from dark brown to black, and is either concolor or mixed more or less with touches of white. It extends generally from the nape to the middle of the back, but is variable in respect to both length and width. The passage into var. *beecheyi* is by almost imperceptible steps.

The specimen (No. 1180) representing the most extreme phase of differentiation from the *beecheyi* form is from Klamath Lake, Oreg. Another quite similar (No. 5897) is marked as probably from Fort Crook, Cal.; it is, however, somewhat browner. No. 536, from Fort Crook, is much like the last; though marked "*beecheyi*", it seems to belong to the *douglassi* series. Another specimen (No. 3616), from Fort Tejon, is but a step removed from the typical *douglassi* phase. Some of the numerous Fort Tejon specimens (var. *beecheyi*) have the middle of the back uniformly dark brown, with a very few touches of white; while the pattern of markings is typically like that of *beecheyi*, the mesial band, though brown rather than black, is darker than any other portion of the dorsal region. In both vars. *beecheyi* and *douglassi*, the scapular mantle is often divided by merely a very narrow line, and at other times by a broad band. The shoulder-patches also vary from very broad silvery-white areas, with slight touches of black, to those that are much narrower, and with a much greater admixture of black. No. 9318, from Virginia City, Nev., has the shoulder-patches nearly obsolete, as in var. *grammurus*, to which this specimen should perhaps be referred. It is, however, very like No. 3618 from Fort Tejon. The intergradation between vars. *beecheyi* and *douglassi* is most thorough.

HABITAT.—Northern California, northward to Washington Territory.

Three skulls of var. *douglassi* give an average length of about 2.30, being somewhat larger than var. *beecheyi* and rather smaller than var. *grammurus*. The skulls of *douglassi* afford no characters by which they can be separated from those of the other varieties.

#### GENERAL REMARKS RESPECTING *SPERMOPHILUS GRAMMURUS* AND ITS VARIETIES.

DISTINCTIVE CHARACTERS AND AFFINITIES.—*Spermophilus grammurus* is widely distinct from all other members of the genus. It is at once recognizable by its long, full, bushy tail, large pointed ears, and its general Sciurine form. It also differs greatly from all the others in color and size, except *S. empetra*,

which is, in fact, its nearest affine, though differing greatly from it in color and in the size of the ears and the character of the tail.

The varieties of *grammurus* differ from each other somewhat in size, but mainly in coloration. The difference in size between var. *grammurus* and *beecheyi*, as indicated by the measurements of the skulls of the two forms, is perhaps in part due to locality; all the *grammurus* specimens being from the Rocky Mountains of Colorado and New Mexico, while the *beecheyi* specimens come almost wholly from Fort Tejon, Lower California. The difference in size between var. *beecheyi* and *douglasi* seems susceptible of a similar explanation, the larger (*douglasi*) being northern. Between *beecheyi* and *douglasi*, the intergradation is most thorough, while *beecheyi* passes gradually into *grammurus*. Specimens from the most distant localities are sometimes quite indistinguishable, as in the case of No. 9568, from Golden City, Colo., and No. 3618, from Fort Tejon, Cal., between which there is no essential difference in coloration. In var. *beecheyi*, the ear appears to be generally a little higher, narrower, and more pointed than in var. *grammurus*.

SYNONYMY AND NOMENCLATURE.—Var. *grammurus* was first described by Mr. Say in 1823, from specimens obtained on the headwaters of the Arkansas, now within the State of Colorado. Its first synonym is the *Spermophilus couchi*, described by Professor Baird, in 1855, from black specimens collected by Lieut. D. N. Couch in the provinces of New Leon and Tamaulipas, near the United States and Mexican boundary-line. It is distinguishable only by its color from var. *grammurus*, of which it is merely a melanistic phase. Its next and only other synonym is the *Spermophilus buckleyi*, described by Dr. Slack in 1861, from a specimen from the Pecos River, also based on specimens in melanistic condition, in which the anterior half of the dorsal surface is black, and the hairs elsewhere have much more black than usual at the tips. Another specimen, from near the same locality, also shows a melanistic tendency. There are also in the collection melanistic specimens of var. *beecheyi* from Fort Tejon. As stated by Professor Baird, the *S. grammurus* of Say was wholly lost sight of for many years, until it was rediscovered by the Government expeditions sent out about 1853-56; it is not alluded to by Audubon and Bachman in their general work on the Quadrupeds of North America; and it is referred to by Dr. Giebel as late as 1855 as a doubtful or indeterminable species.

Vars. *beecheyi* and *douglasi* were both described by Dr. Richardson in

1829, and neither of them have any serious complications of synonymy. The *Spermophilus macrurus*, described by Mr. Bennett in 1833, "from that part of California which adjoins Mexico", is undoubtedly referable to var. *beecheyi*, if the locality is correctly given; the only question that can be raised is as to whether it should be referred to this form rather than to var. *douglassi*. This, however, is a point of minor importance. The size, form, and coloration accord well with var. *beecheyi*; the only point of discrepancy is the "black head, on which a very few white hairs exist". This indicates a slight tendency to melanism, such as quite a number of specimens present, in which the head is unusually blackish. Several specimens of this type of coloration are among those received from Southern California. I have hence not the slightest hesitation in referring *S. macrurus* to one of the Pacific-coast forms of *grammurus*, or, more definitely, to var. *beecheyi*, with whose habitat the alleged locality accords.

The *Sciurus californicus* of Lesson, described in 1847 as from California, seems also undoubtedly referable to var. *beecheyi*, as already suggested by Professor Baird. It is, in fact, with one or two slight exceptions, an excellent and detailed description of this animal. The white bands on the sides are represented as extending rather farther back than usual, but not farther than frequently happens. The color of the tail is alone erroneously described, the description implying that there is but a single band of black instead of three.\*

\*I here subjoin a transcript of Lesson's entire notice of his *Sciurus (Macrozous) californicus*, kindly furnished by Dr. E. J. Nolan, secretary of the Academy of Natural Sciences of Philadelphia, from the copy of Lesson's "Description de Mammifères et d'Oiseaux", etc., contained in the library of the Academy.

"L'ÉCUREUIL DE LA CALIFORNIE.

"(*Sciurus (Macrozous) Californicus*, Lesson.)

"La Californie nourrit plusieurs espèces d'écureuils fort voisines les unes des autres, et qui appartiennent au groupe des Guerlinguets ou des *Tamias*: ce sont les *S. bottas*, Less. (Cent. Zool. pl. 76); *Macrozous nigrescens* (Benn. Proc. 1833, p. 41); *Macrozous microgaster*, F. Cuv. (Mamm. pl. — et Bonite, pl. 10 et 11); *S. nebulosus*, Id. Geoff. (Bonite, pl. 12), et *Tamias mindel*, Gray (Ann. t. x, p. 284).

"Le petit mammifère qui fait l'objet de cette description est de la taille de l'écureuil d'Europe; ses formes sont aussi celles de notre écureuil, mais ses oreilles sont sans pinceaux de poils, et sa queue, garnie de poils serrés, mais peu longs, est aplatie.

"Cet animal que nous nommons californien, parce qu'il vit dans cette partie de l'Amérique, a le museau assez atténué et légèrement comprimé; ses dents incisives sont de l'orangé le plus vif; les yeux sont encadrés d'un cercle blanchâtre, tandis que les poils du dessus de la tête sont tiquetés de brun sur un fond vineux pâle; les joues et le gosier sont gris-clair; les oreilles sont légèrement obovales, couvertes de très-petits poils, mais sans pinceaux; le pelage sur le corps est généralement gris vineux tiqueté de gris-clair et de noir; le fond de cette coloration est plus richement gris sur la nuque et sur le cou, plus roussâtre sur la croupe, et franchement rose vineux sur les membres antérieurs et postérieurs; le gris tiqueté du dos est coupé par une étroite bande blanche, qui s'étend de chaque côté depuis le haut de

**GEOGRAPHICAL DISTRIBUTION.**—The habitat of *Spermophilus grammurus* var. *grammurus* extends from the parks of Central Colorado southward into Mexico, probably to a considerable distance beyond the boundary of the United States. In some portions of Colorado, as in the vicinity of Boulder, whence many specimens have been brought, it appears to be a common and characteristic species. It occurs in Western Texas, but further north does not appear to occur much to the eastward of the eastern base of the Rocky Mountains. It ranges thence westward to, and probably throughout, the Great Basin, at all favorable localities. There are specimens in the collection from Ogden and Provo, Utah, and Virginia City, Nev. Var. *douglassi* ranges from Northern California to Fort Dalles and Klamath Lake, Oreg. In Northern California, it gradually passes into var. *beecheyi*, which ranges thence southward throughout Southern California, and probably further southward. The most southern points represented in the collection are Fort Tejon and San Diego. Specimens referable to *beecheyi* have been collected by Mr. H. W. Henshaw on the eastern slope of the Sierra Nevadas. The species *grammurus* hence ranges from the eastern base of the Rocky Mountains to the Pacific coast, and from beyond the Mexican boundary northward to Central Colorado, Northern Utah, and Oregon.\*

l'épaule jusqu'à la chute des reins, avant la naissance de la queue; les parties inférieures, les flancs, le dedans des membres sont blanchâtres, mais tous les poils de ces parties sont à moitié noirs et terminés de blanc seulement.

"Les soies de cet écureuil sont fines, peu abondantes et noires; le nu des tarses est noirâtre; les ongles faibles et acérés sont bruns; la queue parfaitement aplatie et à poils distiques, est colorée en dessus de noir et de blanc mélangé au milieu, et blanc sur les bords; en dessous elle est blanche, bordée et terminée de noir, puis frangée de poils blancs. Cette coloration est due à ce que chaque poil est blanc à la base, noir au milieu, et blanc au sommet.

"Ce petit écureuil doit, à la faiblesse de ses ongles, vivre uniquement sur les arbres. Nous n'avons pu vérifier son système dentaire parce que le seul individu soumis à notre étude appartenait à un musée, et provenait de la Californie, mais sans indication de localité précise."—"Description de Mammifères et d'Oiseaux récemment découverts, précédée d'un Tableau sur les Races Humaines, par M. LESSON, Paris, 1847", pp. 143-145.)

\* This species is apparently more or less active at southern localities throughout the winter. Mr. T. G. Cary, who formerly resided many years in California, and knows the species well, assures me that about San Mateo they were to be met with abundantly at all seasons, apparently spending no portion of the year in a state of hibernation. This is confirmed by the observations of Dr. Coues, who enjoyed excellent opportunities of studying its habits in Southern California, and who found it as active as ever during the latter part of November, 1865, in the vicinity of San Pedro. Dr. J. G. Cooper also states that on the Los Angeles Plains, in the southern part of the State, they "do not hibernate", but may be seen there in winter actively running about or sitting erect near their burrows.—(*American Naturalist*, vol. iii, p. 129.)

TABLE LXXXII.—Measurements of eleven skulls of *SPERMOPHILUS GRAMMURUS* var. *GRAMMURUS*.

Catalogue-number.	Locality.	Sex.	Total length.	Greatest width.	Distance between orbits.	Nasal bones, length.	Nasal bones, width behind.	Nasal bones, width before.	Upper incisors from front to molars.	Upper incisors from front to hinder margin of palate.	Upper incisors, height.	Upper incisors, width between external edges.	Upper molars, length taken together.	Lower jaw, length.	Lower jaw, height.
13254	Soda Springs, Colo.	.....	2.40	1.53	0.67	0.85	0.92	0.40	0.75	1.30	.....	.....	0.45	1.45	0.68
17639	.....do	.....	.....	.....	0.68	0.78	0.90	0.42	0.70	1.22	.....	.....	0.41	1.31	0.68
13253	.....do	.....	2.35	1.50	0.60	0.83	0.90	0.42	0.77	1.20	.....	.....	0.42	1.35	0.68
13983	Ogden, Utah	.....	.....	1.50	0.65	0.78	0.95	0.42	0.79	1.25	.....	.....	0.46	1.48	0.64
1111	Copper Mines, N. Mex.	♂	2.50	1.53	0.67	0.90	0.98	0.48	0.80	1.35	.....	0.95	0.50	1.45	0.70
1118	.....do	.....	2.50	1.65	0.68	0.90	0.93	0.48	0.82	1.34	0.44	0.95	0.48	1.52	0.70
4803	Santa Fé, N. Mex.	.....	2.35	.....	0.68	0.84	0.18	0.40	0.75	1.26	0.38	0.97	0.48	.....	.....
1483	Tamanlipac, Mex.	.....	2.40	.....	0.67	0.89	0.25	0.48	0.75	1.30	.....	0.90	1.50	0.70	.....
3215	Victoria, Mex.	.....	2.47	1.55	0.65	0.88	0.94	0.46	0.77	1.33	0.36	0.98	0.50	1.51	0.71
*1486	New Leon, Mex.	.....	2.35	1.48	0.57	0.84	0.90	0.40	0.75	1.25	0.40	0.90	0.50	1.40	0.70
1955	Victoria, Mex.	.....	2.33	1.40	0.55	0.78	0.90	0.40	0.73	1.25	0.36	.....	0.59	1.40	0.65

\* "B. couchii."

TABLE LXXXIII.—Measurements of fifteen skulls of *SPERMOPHILUS GRAMMURUS* var. *BRECHYI*.

Catalogue-number.	Original number.	Locality.	Sex.	Total length.	Greatest width.	Distance between orbits.	Nasal bones, length.	Nasal bones, width behind.	Nasal bones, width before.	Upper incisors from front to molars.	Upper incisors from front to hinder margin of palate.	Upper incisors, height.	Upper incisors, width between external edges.	Upper molars, length taken together.	Lower jaw, length.	Lower jaw, height.
.....	936	Fort Tejon, Cal.	.....	2.30	1.50	0.63	0.75	0.90	0.40	0.70	1.20	0.40	0.95	0.47	1.45	0.60
3346	160	.....do	.....	2.25	1.40	0.57	0.70	0.82	0.40	0.70	1.20	0.37	0.96	0.46	1.35	0.60
3393	986	.....do	♂	2.50	1.49	0.58	0.75	0.17	0.60	0.70	1.17	0.36	0.93	0.47	1.38	0.60
3594	130	.....do	.....	2.22	1.45	0.57	0.80	0.83	0.44	0.69	1.18	0.36	0.97	0.45	1.47	0.67
3589	101	.....do	.....	2.25	1.48	0.57	0.80	0.17	0.60	0.70	1.17	0.33	0.93	0.46	1.35	0.65
3590	123	.....do	.....	2.37	1.50	0.59	0.82	0.21	0.44	0.75	1.25	0.45	0.95	0.47	1.48	0.65
3591	111	.....do	.....	2.50	1.38	0.55	0.84	0.90	0.40	0.70	1.17	0.35	0.94	0.46	1.35	0.58
3585	707	.....do	.....	2.25	1.40	0.55	0.76	0.18	0.36	0.68	1.15	0.34	0.94	0.47	1.48	0.63
3565	109	.....do	.....	2.05	1.25	0.48	0.71	0.90	0.38	0.63	1.10	0.34	0.95	0.45	1.35	0.53
3569	261	.....do	.....	2.05	1.28	0.45	0.74	0.18	0.36	0.65	1.12	0.37	0.93	0.45	1.35	0.57
3554	913	.....do	.....	2.15	1.35	0.53	0.75	0.90	0.38	0.68	1.20	0.38	0.98	0.45	1.34	0.65
3568	391	.....do	.....	2.10	1.27	0.52	0.75	0.18	0.40	0.60	1.12	0.36	0.92	0.46	1.30	0.56
3558	549	.....do	.....	2.07	1.25	0.46	0.73	0.90	0.38	0.68	1.10	0.32	0.93	0.45	1.30	0.57
3555	168	.....do	.....	2.30	1.35	0.55	0.75	0.19	0.40	0.68	1.15	0.37	0.94	0.45	1.34	0.68
3557	170	.....do	.....	2.04	1.16	0.46	0.70	0.90	0.38	0.60	1.05	0.30	0.95	0.42	1.18	0.52



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TABLE LXXXIV.—Measurements of three skulls of SPERMOPHILUS GRAMMURUS var. DOUGLASSI.

Catalogue-number.	Locality.	Total length.	Greatest width.	Distance between orbits.	Nasal bones, length.	Nasal bones, width behind.	Nasal bones, width before.	Upper incisors from front to molars.	Upper incisors from front to hinder margin of palato.	Upper incisors, height.	Upper incisors, width between external edges.	Upper molars, length taken together.	Lower jaw, length.	Lower jaw, height.
1881	Oregon .....	8.40	1.50	0.55	0.83	0.35	0.42	0.80	1.35	0.36	0.97	0.50	1.58	0.65
4189	Fort Crook, Cal. ....	8.31	1.45	0.80	0.78	0.38	0.40	0.80	1.33	0.37	0.95	0.48	1.44	0.68
4804	Fort Umpqua, Oreg. ....	8.15	1.30	0.50	0.73	0.32	0.38	0.70	1.30	0.34	0.95	0.45	1.32	0.55

TABLE LXXXV.—Measurements of six specimens of SPERMOPHILUS GRAMMURUS var. GRAMMURUS.

Catalogue-number.	Original number.	Locality.	From tip of nose to—					Tail to end of—		Length of—		Height of ear.	Nature of specimen.
			Sex.	Eye.	Nar.	Occiput.	Tail.	Vertebra.	Hairs.	Fore foot.	Hind foot.		
3638	.....	Fort Stanton, N. Mex. ....	.....	.....	.....	.....	13.00	7.87	R. T.	.....	2.30	.....	Skin.
1925	.....	Fort Webster, N. Mex. ....	.....	.....	.....	.....	10.50	8.00	.....	.....	.....	.....	do.
196	.....	Copper Mines, N. Mex. ....	♂	1.10	2.30	8.70	12.75	8.50	10.30	1.40	2.35	0.65	do.
365	.....	Apache, Ariz. ....	♂	.....	.....	.....	12.50	8.10	9.80	1.45	2.30	0.60	do.
11877	706	.....do.....	♂	.....	.....	.....	11.00	7.00	9.00	1.42	2.15	.....	do.
608	.....	.....do.....	♀	.....	.....	.....	11.50	7.50	9.10	1.37	2.17	.....	do.

\* From Baird, Mam. N. Amer. p. 311.

TABLE LXXXVI.—Measurements of eight specimens of SPERMOPHILUS GRAMMURUS var. DEECHEVI.

Catalogue-number.	Locality.	Sex.	From tip of nose to—					Tail to end of—		Length of—		Height of ear.	Nature of specimen.	Remarks.
			Eye.	Nar.	Occiput.	Tail.	Vertebra.	Hairs.	Fore foot.	Hind foot.	.....			
1597	San Diego, Cal. ....	.....	.....	.....	.....	11.35	.....	6.00	.....	2.10	.....	.....	Skin	From Baird, Mam. N. Amer. p. 306.
1599	.....do.....	.....	.....	.....	.....	11.50	7.00	.....	.....	.....	.....	.....	do.	
470	Tejon Valley, Cal. ....	.....	.....	.....	.....	10.75	8.12	9.75	.....	2.30	.....	.....	do.	
1181	Santa Clara, Cal. ....	.....	.....	.....	.....	10.00	.....	7.00	.....	2.10	.....	.....	do.	
*284	San Mateo, Cal. ....	♂	1.08	2.15	8.50	10.30	5.75	7.75	1.35	2.25	0.75	.....	Alcohol.	
*247	.....do.....	♂	1.15	2.30	8.40	11.50	6.00	8.00	1.35	2.30	0.85	.....	do.	
*283	.....do.....	♂	1.00	2.05	8.35	10.85	6.35	8.70	1.40	2.05	0.77	.....	do.	
*248	.....do.....	♂	1.07	2.53	8.45	9.50	6.00	7.30	1.30	2.05	0.72	.....	do.	

\* Specimens in Museum of Comparative Zoölogy, Cambridge, Mass.



TA XXXVII.—Measurements of two specimens of *SPERMOPHILUS GRAMMURUS* var. DOUGLASSI.

Catalogue number.	Locality.	Sex.	From tip of nose to—		Tail to end of vertebrae.	Length of hind foot.	Nature of specimen.	Remarks.
			Occiput.	Tril.				
1005	Fort Dalles, Oreg. Ter.	♂	12.00	8.25	0.50	2.60	Skin	From Baird, Mem.
999	.....do	♀	10.50	7.25	0.25	.....	do	N. Amer. p. 309.

TABLE LXXXVIII.—List of specimens examined of *SPERMOPHILUS GRAMMURUS* var. *GRAMMURUS*.

Catalogue number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
8318				Virginia City, Nev.		Clarence King	R. Ridgway	Skin.
11139	13853	3	♀	Ogden, Utah	June 15, 1878	Dr. F. V. Hayden	C. H. Merriam	Skin and skull.
11135	.....do	.....do	.....do	.....do	June 6, 1878	.....do	.....do	Skin.
11133	.....do	.....do	.....do	.....do	June 17, 1878	.....do	W. B. Platt	.....do
11191	.....do	.....do	.....do	.....do	June 15, 1878	.....do	C. H. Merriam	.....do
9569				Soda Springs, Colo.	Aug. 10, 1899	.....do	J. Stevenson	.....do
9562	.....do	.....do	.....do	.....do	Aug. 10, 1899	.....do	.....do	.....do
9568	.....do	.....do	.....do	.....do	Aug. 10, 1899	.....do	.....do	.....do
9584	13254	.....do	.....do	.....do	Aug. 10, 1899	.....do	.....do	Skin and skull.
9563	13253	.....do	.....do	.....do	Aug. 10, 1899	.....do	.....do	.....do
9586	13252	.....do	.....do	.....do	Aug. 10, 1899	.....do	.....do	.....do
9587	.....do	.....do	.....do	.....do	Aug. 10, 1899	.....do	.....do	Skin.
9588	.....do	.....do	.....do	Near Golden City, Colo.	.....do	.....do	.....do	.....do
11147		19	♀	Provo, Utah		Lt. G. M. Wheeler	H. W. Henshaw	.....do
496				Mimbres and Rio Grande		Dr. T. C. Henry	Dr. T. C. Henry	.....do
1046				Los Angeles, Sonora		Maj. W. H. Emory	Dr. C. R. R. Konnerly	.....do
89				Columbia River		Phil. Acad. Nat. Sci.	J. K. Townsend	.....do
497				New Mexico		Dr. J. H. Webb	Dr. J. H. Webb	.....do
495				Mimbres and Rio Grande, N. Mex.		Dr. T. C. Henry	Dr. T. C. Henry	.....do
4965	4903			Santa Fé, N. Mex.		W. J. Howard	W. J. Howard	Skin and skull.
196				Copper Mines, Ariz.		Col. J. D. Graham	J. H. Clark	Skin.
125	1111	.....do	.....do	.....do	.....do	.....do	.....do	Skin and skull.
.....	1119	.....do	.....do	.....do	.....do	.....do	.....do	Skull.
519	1633	.....do	.....do	Western Texas		Dr. T. C. Henry	Dr. T. C. Henry	Skin and skull.
8638	.....do	.....do	.....do	.....do	.....do	.....do	.....do	Skin.
*3696				Fort Mason, Tex.		J. H. Thomas	J. H. Thomas	.....do
*4001	.....do	.....do	.....do	.....do	.....do	.....do	.....do	.....do
11877	706	♂		Apache, Ariz.	Sept. 6, 1873	Lt. G. M. Wheeler	H. W. Henshaw	.....do
.....	505	♂		.....do	Aug. —, 1873	.....do	.....do	.....do
.....	686	♀		.....do	.....do	.....do	.....do	.....do
.....	1425			Tamaliipa, Mex.		Lt. D. N. Couch	Lt. D. N. Couch	Skull.
.....	1492			New Leon, Mex.		.....do	.....do	.....do
336	1265	.....do	.....do	Victoria, Mex.		.....do	Dr. L. Berlandier	Skin and skull.

\* Types of *S. beecheyi*.

SCIURIDÆ—SPERMOPHILUS GRAMMURUS VAR. BEECHEYI. 837

TABLE LXXX.—List of specimens examined of SPERMOPHILUS GRAMMURUS var. BEECHEYI.

Catalogue-number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
583				San Mateo, Cal.		T. G. Cary	T. G. Cary	Alcoholic.
594				do		do	do	do.
947				do		do	do	do.
948				do		do	do	do.
5819		♀		Fort Crook, Cal.		Capt. John Fellner	Capt. John Fellner	Skin.
608				San Francisco, Cal.		R. D. Cutts	R. D. Cutts	do.
606				do		do	do	do.
494				Monterey, Cal.		Dr. A. L. Heermann	Dr. A. L. Heermann	do.
493				San Diego, Cal.		A. Casiday	A. Casiday	do.
5234				Santa Clara, Cal.		Dr. J. G. Cooper	Dr. J. G. Cooper	do.
1181				do		do	do	do.
3892				Sierra Nevada Mts., near Genoa	June 17, 1859	Capt. J. H. Simpson	C. S. McCarthy	do.
3891				do	June 14, 1859	do	do	do.
3993				do		do	do	do.
	1718			Fort Reading, Cal.		Dr. J. F. Hammond	Dr. J. F. Hammond	Skull.
	9184			Gila River, Ariz.		Dr. Antisell	Dr. Antisell	do.
469				Tejon Valley, Cal.		Dr. A. L. Heermann	Dr. A. L. Heermann	Skin.
467				do		do	do	do.
468				do		do	do	do.
470				do		do	do	do.
3673		1858	♂	Fort Tejon, Cal.		John Xantus	John Xantus	do.
3677		1859	♀	do		do	do	do.
3648		2577	♀	do		do	do	do.
3630		1864	♂	do		do	do	do.
3640		1866	♀	do		do	do	do.
3640		2858	♂	do		do	do	do.
3597		31		do		do	do	do.
3586		159		do		do	do	do.
3619		578	♂	do		do	do	do.
3596		183		do		do	do	do.
3590		191		do		do	do	do.
3600		533		do		do	do	do.
3594		154		do		do	do	do.
3585		158		do		do	do	do.
3638		160		do		do	do	do.
3616				do		do	do	do.
3607		913		do		do	do	do.
*3647				do		do	do	do.
3589		578		do		do	do	do.
3600		847	♂	do		do	do	do.
3618		3		do		do	do	do.
3599		609		do		do	do	do.
3830		777	♂	do		do	do	do.
3881		732		do		do	do	do.
3802		449		do		do	do	do.
3001		064	♂	do		do	do	do.
3003		534		do		do	do	do.
	3360	109		do		do	do	do.
	3054	613		do		do	do	Skull.
	3353	169		do		do	do	do.

\* Back.

TABLE LXXXIX.—List of specimens examined of *SPERMOPHILUS GRAMMURUS* var. *BERCHEYI*—Continued.

Catalogue-number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
3356	160			Fort Tejon, Cal.		John Xantus	John Xantus	Skull.
3357	160			do		do	do	do.
3358	548			do		do	do	do.
3359				do		do	do	do.
3360	581			do		do	do	do.
3361				do		do	do	do.
3362				do		do	do	do.
3363	391			do		do	do	do.
3364				do		do	do	do.
3365	169			do		do	do	do.
3366	191			do		do	do	do.
3367				do		do	do	do.
3368	130			do		do	do	do.
3369	703			do		do	do	do.
3370				do		do	do	do.
3371				do		do	do	do.
3372				do		do	do	do.
3373				do		do	do	do.
3374	132			do		do	do	do.
3375	111			do		do	do	do.
3376	966			do		do	do	do.
3377				Tejon Valley, Cal.		do	do	do.
3378				do		do	do	do.
3379				do		do	do	do.
3380				do		do	do	do.
3381				do		do	do	do.
3382				do		do	do	do.
3383				do		do	do	do.
3384				do		do	do	do.
3385				do		do	do	do.
3386				do		do	do	do.
3387				do		do	do	do.
3388				do		do	do	do.
3389				do		do	do	do.
3390				do		do	do	do.
3391				do		do	do	do.
3392				do		do	do	do.
3393				do		do	do	do.
3394				do		do	do	do.
3395				do		do	do	do.
3396				do		do	do	do.
3397				do		do	do	do.
3398				do		do	do	do.
3399				do		do	do	do.
3400				do		do	do	do.
3401				do		do	do	do.
3402				do		do	do	do.
3403				do		do	do	do.
3404				do		do	do	do.
3405				do		do	do	do.
3406				do		do	do	do.
3407				do		do	do	do.
3408				do		do	do	do.
3409				do		do	do	do.
3410				do		do	do	do.
3411				do		do	do	do.
3412				do		do	do	do.
3413				do		do	do	do.
3414				do		do	do	do.
3415				do		do	do	do.
3416				do		do	do	do.
3417				do		do	do	do.
3418				do		do	do	do.
3419				do		do	do	do.
3420				do		do	do	do.
3421				do		do	do	do.
3422				do		do	do	do.
3423				do		do	do	do.
3424				do		do	do	do.
3425				do		do	do	do.
3426				do		do	do	do.
3427				do		do	do	do.
3428				do		do	do	do.
3429				do		do	do	do.
3430				do		do	do	do.
3431				do		do	do	do.
3432				do		do	do	do.
3433				do		do	do	do.
3434				do		do	do	do.
3435				do		do	do	do.
3436				do		do	do	do.
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3438				do		do	do	do.
3439				do		do	do	do.
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3443				do		do	do	do.
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3446				do		do	do	do.
3447				do		do	do	do.
3448				do		do	do	do.
3449				do		do	do	do.
3450				do		do	do	do.
3451				do		do	do	do.
3452				do		do	do	do.
3453				do		do	do	do.
3454				do		do	do	do.
3455				do		do	do	do.
3456				do		do	do	do.
3457				do		do	do	do.
3458				do		do	do	do.
3459				do		do	do	do.
3460				do		do	do	do.
3461				do		do	do	do.
3462				do		do	do	do.
3463				do		do	do	do.
3464				do		do	do	do.
3465				do		do	do	do.
3466				do		do	do	do.
3467				do		do	do	do.
3468				do		do	do	do.
3469				do		do	do	do.
3470				do		do	do	do.
3471				do		do	do	do.
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3474				do		do	do	do.
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3495				do		do	do	do.
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3497				do		do	do	do.
3498				do		do	do	do.
3499				do		do	do	do.
3500				do		do	do	do.
3501				do		do	do	do.
3502				do		do	do	do.
3503				do		do	do	do.
3504				do		do	do	do.
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3542				do		do	do	do.
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3549				do		do	do	do.
3550				do		do	do	do.
3551				do		do	do	do.
3552				do		do	do	do.
3553				do		do	do	do.
3554				do		do	do	do.
3555				do		do	do	do.
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3570				do		do	do	do.
3571				do		do	do	do.
3572				do		do	do	do.
3573				do		do	do	do.
3574				do		do	do	do.
3575	</							

SPERMOPHILUS EMPETRA (Pall.) Allen.

Parry's *Spermophile*.

Var. EMPETRA.

- Glis canadensis* ERXLEBEN, Syst. Anim. 1777, 363 (in part only; = Quebec Marmot of Pennant + Quebec Marmot of Forster).  
*Mus empetra* PALLAS, Nov. Spec. Glires, 1778, 74 (except the reference to Pennant's Quebec Marmot).—  
 "BODDERT, Elouche. Anim. i, 1784, 105."  
*Arctomys empetra* SCHREBER, Säuget. iv (1784), 743, pl. ccx (= *Mus empetra* Pallas, the plate from Pallas's type).—GMELIN, Syst. Nat. i, 1788, 143 (= *empetra* of Pallas and Schreber).—SHAW, Gen. Zool. ii, 1801 (name as preceding).—DESMAREST, Mam. 1822, 329; and of various subsequent compilers.—SABINE, Trans. Linn. Soc. xiii, 1822, 584 (the synonymy, excluding references to Pennant's Quebec Marmot; not the description).—RICHARDSON, Fauna Bor.-Am. i, 1829, 147 (in small part only; not the figure nor the description).  
*Arctomys parryi* RICHARDSON, Parry's Second Voyage, App. 1825, 316.—HARLAN, Fauna Amer. 1825, 170.—GODMAN, Am. Nat. Hist. ii, 1826, 120.—H. SMITH, Griffith's Cuvier's An. King. v, 1827, 247.—FISCHER, Synop. Mam. 1829, 344.—J. C. ROSS, Ross's 2d Voy. 1835, App. xv (Repulse Bay).—WAGNER, Schreber's Säuget. pl. cxx.—TORELL, Petermann's Mittheil. 1861, 67.  
*Arctomys (Spermophilus) parryi* RICHARDSON, Faun. Bor.-Amer. i, 1829, 158, pl. x; Zool. Beechey's Voy. Mam. 1830, 7.  
*Spermophilus parryi* LESSON, Man. de Mam. 1827, 244.—BRANDT, Bull. Phys.-Math. Class. St. Petersburg. ii, 1844, 372.—SCHINZ, Syn. Mam. ii, 1845, 65.—GIBBEL, Säuget. 1855, 633.—BAIRD, Mam. N. Amer. 1857, 323.  
*Spermophilus parryi* var. *parryi* ALLEN, Proc. Bost. Soc. Nat. Hist. xvi, 1874, 292.  
*Arctomys alpinus* PARRY, Nar. Sec. Voy. 1825, 61 (name merely; said by Richardson to refer to his *Arctomys parryi*).  
*Arctomys (Spermophilus) parryi* var.  $\gamma$ , *phæognatha* RICHARDSON, Faun. Bor.-Amer. i, 1829, 161.  
*Spermophilus parryi* var.  $\gamma$  *phæognatha* ALLEN, Proc. Bost. Soc. Nat. Hist. xvi, 1874, 292.  
*Arctomys kennicottii* ROSS, Canad. Nat. and Geol. 1861, 434; Nat. Hist. Rev. 1862, 274.  
*Quebec Marmot*, FORSTER, Phil. Trans. lxii, 1772, 378 (not the Quebec Marmot of Pennant).  
*Ground Squirrel*, HEARNE, Journey, 1807, 141, 386.

Var. KODIACENSIS.

- Spermophilus parryi* var. *kodiacensis* ALLEN, Proc. Bost. Soc. Nat. Hist. xvi, 1874, 292.

Var. ERYTHROGLUTEUS.

- Arctomys (Spermophilus) parryi* var.  $\beta$ , *erythrogluteus* RICHARDSON, Faun. Bor.-Amer. i, 1829, 161.  
*Spermophilus parryi* var. *erythrogluteus* ALLEN, Proc. Bost. Soc. Nat. Hist. xvi, 1874, 292.

Var. EMPETEA

VARIETAL CHARS.—Size of *S. grammurus*, or rather larger. Length of head and body 12.00 to 14.00; of tail to end of vertebrae 3.00; to end of hairs about 4.50. Above mixed yellowish-brown, white, and black, the white forming quite prominent squarish blotches; sides of the head, neck, and body, the limbs, and whole lower surface brownish-yellow, varying greatly in intensity in different individuals; top of the head cinnamon, varying to chestnut, more or less mixed with blackish. A pale ring surrounds the eyes.

Tail below dark brownish-red, with a subterminal bar of black, which extends back for a short distance along the sides; above mixed gray, brown, and black, with a broad border of black edged with yellowish-white. A melanistic race, wholly intense black, is frequent at some localities.

The general form of the body is rather stout and thick; the tail short and bushy, incompletely distichous, in form somewhat resembling that of *Arctomys*; ears low and broad, about one-fifth to one-sixth of an inch high.

Specimens from the same localities vary considerably in color, especially in respect to the distinctness of the white spots and the amount of rufous suffusion. In Fort Anderson specimens, the white spots are generally large and well defined; the lower parts are strongly rufous, often bright tawny, particularly on the sides, throat, and breast; sometimes bright tawny throughout below, with the top of the head bright brownish-orange. Specimens pure glossy black, with a faint wash of gray or yellowish-gray on the shoulders and thighs, are of frequent occurrence in the vicinity of Fort Yukon.

Var. KODIACENSIS.

VARIETAL CHARs.—Size of var. *empetra*. Grayer; the white blotches finer and more crowded; the top of the head and the back of a darker brown; *sides and beneath gray*, sometimes washed with fulvous over the abdomen; tail shorter and more bushy.

A considerable number of specimens from Kodiak Island agree in being of a much paler or grayer phase of coloration than specimens from the Yukon and Anderson's Rivers. While the top of the head is of a much darker shade of brown, with the brown of the middle of the back also darker, the nape, sides of the head and neck, the outer side of the limbs, and the sides of the body, as well as the lower surface generally, but especially the throat and breast, are much lighter, being nearly *pure gray* instead of *tawny*, as in var. *empetra*. While the general size is nearly the same, the tail is about one-fourth to one-third shorter and more bushy. The Kodiak form is characterized by generally an almost entire absence of fulvous, which in var. *empetra* is generally intensified into brownish-golden; in some specimens of *kodiacensis*, the middle of the belly is more or less fulvous, as are sometimes the shoulders. In general color, var. *kodiacensis* much more closely resembles *S. evermanni*, but, in its much shorter tail, differs more from it than does var. *empetra*.

## Var. ERYTHROGLUTEUS.

VARIETAL CHARS.—Somewhat smaller than var. *empetra*, with longer ears and tail. Length of head and body about 9.50 (to 11.00, according to Richardson); of tail to end of vertebrae 3.50; to end of hairs 5.00. Color similar, but darker, with the lighter markings generally more fulvous.

Two skulls of var. *erythrogluteus* give an average length of 2.05 against 2.25 in six skulls of var. *empetra*; average width 1.27 against 1.48 in var. *empetra*. The skull is hence relatively narrower and more elongate than in the latter, and the postorbital processes are more slender. Part of this difference may, however, be the result of differences of age, the *erythrogluteus* skulls being from younger animals than the others.

This variety was first described by Dr. Richardson, from specimens procured west of the Rocky Mountains, "near the sources of the Elk River, in latitude 57°". Two of the five specimens before me are from the Kootenay River, two from the head of Flat Head River, and the other from the upper end of Plover Bay. These agree with Dr. Richardson's description, except that they are rather smaller. They are also from considerably more southern localities. In one specimen, the light blotches are as distinct and as light as in var. *empetra*.

## GENERAL REMARKS RESPECTING SPERMOPHILUS PARRYI AND ITS VARIETIES.

DIFFERENTIAL CHARACTERS AND AFFINITIES.—*Spermophilus empetra*, in all its forms, is widely different from any other North American Spermophile, with none of which it is necessary to compare it in detail. It more nearly approaches *S. grammurus* than any other, especially in cranial characters. It has larger ears than any other of the species of the subgenus *Colobotis*, and in general features stands between *Otospermophilus* and *Colobotis*, but agrees best with the latter.

It finds in the Siberian *S. eversmanni* a very near ally, but *S. empetra* differs from *S. eversmanni* in being larger, with a much shorter tail and more rufous on the head. Var. *kodiacensis*, from the island Kodiak, situated off the southern coast of the Alaskan Peninsula, in color very closely resembles the *S. eversmanni*, but it has a shorter tail than even var. *empetra*. Examples from Ärikamtchitchi Island and the western shore of Behring's Strait are still more like *S. eversmanni*, yet are not varietally separable from var. *empetra*.

SYNONYMY AND NOMENCLATURE.—This species was first noticed in 1772

by Forster, who described a specimen from Churchill River as the "Quebec Marmot", doubtfully referring it to Pennant's Quebec Marmot, which is the *Arctomys monax* of recent authors, but generally wrongly referred to the *Mus empetra* of Pallas. Forster's description shows clearly that his animal, as first stated by Richardson,\* is identical with his *S. parryi*. Hearne, during his long Arctic journey (1769-72), also met with it in the region west of Hudson's Bay, and in his narrative of his travels, published in 1807, refers to it under the name "Ground Squirrel".

In 1778, Pallas described a *Mus empetra*, based on a specimen in the Leyden Museum from boreal America, which is unquestionably referable to the present species, subsequently (in 1825) described by Richardson under the name *Arctomys parryi*. His account of the size, form, proportions, and color are all applicable here, and not at all to *Arctomys monax*, to which his name has commonly of late been referred. A few years later (about 1784), Pallas's *Mus empetra* was redescribed by Schreber under the name *Arctomys empetra*. Schreber also gave of it a colored figure, made from a drawing of Pallas's *Mus empetra* sent to him by Pallas himself. This figure, as no one can well doubt, is a fair representation of the *Arctomys parryi* of Richardson, the *Spermophilus parryi* of recent authors. Pallas cites, as a synonym of his *Mus empetra*, the Quebec Marmot of Pennant, and also the Quebec Marmot of Forster.† Pallas, in thus citing Pennant, referred an unquestionably distinct species to his *Mus empetra*, which complication was perpetuated by subsequent writers, who uniformly blended Pennant's Quebec Marmot with Forster's Quebec Marmot and Pallas's *Mus empetra*. The animal described by Pallas, however, as already stated, is the *Arctomys parryi* of later authors, as is fully shown by the publication of his figure by Schreber, and as is also unquestionably evident from his description.‡ This is evident from the short tail, small size, and coloration, in these points the figure and description agreeing with no American species of the restricted

\* Parry's 2d Voy. App. p. 318.

† These citations, rendered by Pallas into Latin, are as follows:—"Marmota quebekana PENNANT, Syn. p. 270. Sp. 199, tab. 24, f. 2, bona. FORSTER, Act. angl. vol. LXII, p. 378."

‡ Pallas's description, from the specimen in the Leyden Museum, is as follows:—"Magnitudo Cavim Pacis, seu inter Marmotam & Citillam media; habitus plane Marmote vel Arctomyos; longitudo circiter pedalis. Caput rotundum, supra fusco-nigrescens, lateribus albicans. Dentes primores magni, nudati ut in Marmota, nec antice fulvi. Auricula parva, subnulla, rotundata, vix pilo longiora. Verrucae plures sparse, supercillares biactae, paroticae biactae, pilis albidis distinctae, gularis uniseta. Corpus subtile totum artusque rufo-ferruginea; supra corpus fuscum, extremis pilorum e gryseo-albicantibus undulato nebulosum. Pedes extremi brunneo nigri, unguibus fuscis; palma sine venticlo pollicis. Cauda bipollicaris cum dimidio, dorso concolor, apice nigrescens."—(Nor. Spec. Glires, p. 75.)



genus *Arctomys*. The only point of discrepancy is the "palmæ sine vestigio pollicis", which is almost equally valid against the reference of Pallas's *Mus empetra* to any American species of *Arctomys*. While it is difficult to satisfactorily make out what Pennant's original Quebec Marmot is, the statement "larger than a Rabbit" shows it was not *A. parryi*.\* It was in all probability based on a northern example of *Arctomys monax*. Sabine, in 1822, while citing *Mus empetra* of Pallas, and all the reference subsequently, to that time, based on it, as well as Pennant's and Forster's Quebec Marmot, was the first to describe a specimen of the northern form of *Arctomys monax* under the specific name *empetra*. Sabine himself, however, noticed the discrepancies between Forster's account of his Quebec Marmot and his own *Arctomys empetra*, and also refers to the want of agreement between Pallas's account of *Mus empetra* and his own specimen. He says:—"But that specimen [Forster's] was only eleven inches, and the tail three inches long; it could not therefore have been fully grown. Pallas described the animal from a specimen in the Leyden Museum, and gave it the name *Empetra*; this did not exceed a foot in length, and its tail was only two inches and a half long. . . . The chestnut color of the head is mentioned by Forster, and therefore is probably to be found in some instances, though on the specimen I have seen there is no such appearance."—(*Trans. Linn. Soc.* xiii, 1822, pp. 585, 586.) Richardson, in 1825, in describing *Arctomys parryi*, distinctly identifies Forster's Quebec Marmot with his *A. parryi*,† but makes no reference to the *Mus empetra* of Pallas, nor to the *empetra* of Schreber, Gmelin, and other early systematic authors. Excepting Pallas's unfortunate reference to Pennant's almost unrecognizable Quebec Marmot, the whole account of his *Mus empetra* relates unquestionably to the animal subsequently known as Parry's Marmot, and it hence becomes necessary to adopt the name *empetra* in place of *parryi* for that species.

Parry, in 1825, barely alludes to his meeting with an animal he termed

\* The Quebec Marmot of Pennant's first edition of his *Synopsis of Quadrupeds* (1771) is not by any means the Quebec Marmot of the second edition of his *Arctic Zoology* (1793). In the latter, the description is so far modified as to also cover the *Mus empetra* of Pallas and the Quebec Marmot of Forster. He says:—"The specimen which I formerly saw at Mr. Brook's, alive, appeared larger than a Rabbit; but the specimen in the Royal Society's Museum [Forster's specimen] was only eleven inches long from the nose to the tail, and the tail three inches. This probably was a young one."—(*Arctic Zoology*, vol. i, 1793, p. 193.)

† Forster, in the *Philosophical Transactions*, describes a specimen of the *A. parryi* procured from Churchill, under the name of the Quebec Marmot, at the same time expressing his doubts of its identity with that animal."—RICHARDSON, *Parry's Second Voy.* App. p. 318.)



"*Arctomys alpina*", which Richardson says is the same as his *Arctomys parryi*, probably from knowing personally the specimens referred to, since Parry's allusion gives no clue, further than the significance of the name, to the character of the animal to which he refers. Richardson, the same year (1825), gave a detailed account of the species, including much relating to its habits and distribution, and bestowed upon it the specific name by which it has since been currently known. In 1829, it was again described by the same author, at which time he characterized and named two additional varieties, namely, *erythrogluteia* and *phaognatha*. Of the latter, Richardson says:—"It is characterized chiefly by a well-defined, deep, chestnut-colored mark under the eye." It was based on a specimen in the Museum of the Zoölogical Society of London, brought from Hudson's Bay; the particular district, however, not being stated. In one of my specimens of var. *erythrogluteus*, there is also a well-defined chestnut-colored line beneath the eye, and a similar mark is faintly indicated in quite a number of the examples of var. *empetra*. It hence seems probable that Richardson's "var. *phaognatha*" may be based merely on a specimen of var. *empetra* in which this mark was developed with unusual distinctness.

The species was redescribed by Baird in 1857, who directed attention to its close resemblance to *S. eversmanni*. In 1861, Mr. B. R. Ross gave to it the name "*Arctomys kennicottii*", under the impression that it had not been previously described.\* In 1874, in my Synopsis of the North American *Sciuridae*, I briefly characterized the variety *kodiacensis*.

GEOGRAPHICAL DISTRIBUTION.—According to Richardson, "This Spermophile inhabits the Barren Grounds skirting the sea-coast from Churchill in Hudson's Bay round by Melville Peninsula, and the whole northern extremity of the continent to Behring's Straits, where specimens precisely similar were procured by Captain Beechey. It abounds in the neighborhood of Fort Enterprise, near the southern verge of the Barren Grounds, in latitude 65°, and is plentiful on Cape Parry, one of the most northern parts of the continent. It is found generally", he adds, "in stony districts, but seems to delight chiefly in sandy hillocks amongst rocks, where burrows, inhabited by different individuals, may be often observed crowded together. One of the

\* I find no farther description of the *A. kennicottii* than the following:—"Arctomys Kennicottii (Ross). This I consider to be a new species; but I may be wrong. It is of small size, and inhabits the Northernmost ranges of the Rocky Mountains."—(B. R. Ross, *Nat. Hist. Review*, 1862, p. 274.) As shown by specimens thus labelled by him in the National Museum, his *A. kennicottii* is the true *S. empetra* (= *S. parryi* auct.).

society is generally observed sitting erect on the summit of the hillock, whilst the others are feeding in the neighborhood. Upon the approach of danger, he gives the alarm, and they instantly betake themselves to their holes, remaining chattering, however, at the entrances until the advance of the enemy obliges them to retire to the bottom.\* It extends southward in the interior at least to Fort Yukon. Mr. B. R. Ross, in notes sent with specimens (labelled "*Arctomys kennicottii*") to the Smithsonian Institution, says it is "numerous in the Barren Grounds, as well as along the Arctic Coast, and by no means scarce along the Anderson and Lockhart Rivers; also numerous below Good Hope, on the Mackenzie; they burrow in considerable numbers, one always acting as sentinel while the others feed and otherwise disport themselves". Most of the specimens in the collection are from the vicinity of Forts Anderson and Yukon. It also extends considerably to the southwestward along the Yukon River; and Dr. Richardson also gives it as ranging on the Pacific coast from British Columbia (formerly New Caledonia) to the Icy Cape.† It also occurs on the Asiatic side of Behring's Strait, and also, according to authors, in Kamtschatka. To the southwestward it passes into the smaller, darker, and longer-tailed var. *erythrogluteus*, which extends southward to the forty-ninth parallel.

TABLE XCI.—Measurements of six skulls of SPERMOPHILUS EMPETRA var. EMPETRA.

Catalogue-number.	Locality.	Total length.	Greatest width.	Distance between orbits.	Nasal bones, length.	Nasal bones, width behind.	Nasal bones, width before.	Upper incisors from front to molars.	Upper incisors from front to hinder margin of palate.	Upper incisors, height.	Upper incisors, width between external edges.	Upper molars, length taken together.	Lower jaw, length.	Lower jaw, height.
6360	Fort Yukon.....	2.40	1.55	0.58	0.83	0.38	0.44	0.74	1.28	0.33	0.35	0.59	1.80	0.64
6367	.....do.....	2.36	1.50	0.47	0.76	0.38	0.40	0.70	1.31	0.35	0.35	0.55	1.51	0.65
6363	.....do.....	2.33	1.45	0.48	0.75	0.35	0.40	0.65	1.23	0.31	0.33	0.53	1.37	0.63
6368	.....do.....	2.17	1.43	0.47	0.75	0.35	0.36	0.68	1.23	0.32	0.36	0.55	1.50	0.63
6351	.....do.....	2.15	1.45	0.45	0.75	0.35	0.40	0.68	1.20	.....	0.32	0.54	1.46	0.65
6363	Fort Good Hope.....	2.37	.....	0.55	0.85	0.35	0.36	0.70	1.35	0.31	0.34	0.58	1.53	0.67

\* Fauna Boreali-Americana, vol. i, p. 156, 1829.

† Zool. Beechey's Voy. Mam. p. 7, 1839.

TABLE XCII.—Measurements of three skulls of *SPERMOPHILUS EMPETRA* var. *ERYTHROGLUTEUS*.

Catalogue-number.	Locality.	Sex.	Total length.	Greatest width.	Distance between orbits.	Nasal bone, length.	Nasal bone, width behind.	Nasal bone, width before.	Upper incisors from front to molars.	Upper incisors from front to higher margin of palate.	Upper incisors, height.	Upper incisors, width between external ridges.	Upper molars, length taken together.	Lower jaw, length.	Lower jaw, height.
4800	Kootenay River .....	♂	2.05	1.30	0.44	0.74	0.30	0.33	0.56	1.10	0.30	0.28	0.50	1.35	0.40
4801	.....do .....	♂	2.05	1.25	0.42	0.73	0.32	0.40	0.57	1.07	0.28	0.26	0.50	1.26	0.38
6887	Head of Flat Head River ..	♀	1.78	1.19	0.35	0.60	0.30	0.38	0.46	0.97	0.24	0.23	0.45	1.02	0.35

TABLE XCIII.—Measurements of four specimens of *SPERMOPHILUS EMPETRA* var. *ERYTHROGLUTEUS*.

Catalogue-number.	Locality.	Sex.	From tip of nose to—				Tail to end of—		Length of—		Height of ear.	Measure of specimen.
			Eye.	Ear.	Occiput.	Tail.	Vertebra.	Hairs.	Fore foot.	Hind foot.		
5195	Washington Territory .....	♂	0.82	1.70	2.05	9.25	3.30	4.70	1.90	1.87	0.30	Alcoholic.
4782	.....do .....	♂	0.78	1.50	1.83	7.00	2.50	3.55	1.10	1.55	0.30	.....do.
5944	Kootenay River, Wash. Ter. ....	♂	0.75	1.50	.....	9.00	3.50	5.25	1.35	1.85	0.35	.....do.
11287	Head of Plover Bay .....	♂	1.00	2.05	2.30	9.50	3.00	5.00	1.50	2.10	.....	.....do.

TABLE XCIV.—List of specimens examined of *SPERMOPHILUS EMPETRA* var. *EMPETRA*.

Catalogue-number on skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
9651	.....	.....	.....	Atikamechichi Island .....	.....	U. S. Expl. Exped	W. Stimpson .....	Skin.
3290	.....	.....	.....	Behring's Strait .....	.....	.....do .....	.....do .....	.....do.
8734	1703	.....	.....	Fort Anderson .....	.....	L. Anderson .....	L. Anderson .....	.....do.
8834	1703	.....	.....	.....do .....	.....	.....do .....	.....do .....	.....do.
8733	1763	.....	.....	.....do .....	—, 1884	R. McFarlane .....	R. McFarlane .....	.....do.
8735	.....	.....	.....	.....do .....	.....	.....do .....	.....do .....	.....do.
3157	.....	.....	.....	Anderson River .....	Nov., 1885	.....do .....	.....do .....	.....do.
8736	1187	♀	.....	East of Fort Anderson .....	June 21, 1885	.....do .....	.....do .....	.....do.
8737	.....	♂	.....	Fort Anderson .....	Sept. 8, 1884	.....do .....	.....do .....	.....do.
.....	4459	♂	.....	.....do .....	Aug. 1, 1885	.....do .....	.....do .....	.....do.
.....	1329	.....	.....	.....do. ? .....	.....	.....do .....	.....do .....	.....do.
8046	.....	.....	.....	Liverpool Bay .....	.....	.....do .....	.....do .....	.....do.
8649	.....	.....	.....	.....do .....	.....	.....do .....	.....do .....	.....do.
.....	649	.....	.....	Rocky Mountains, H. B. T. .	July 30, 1882	J. Lockhart .....	J. Lockhart .....	.....do.
5969	635	.....	.....	Lockhart River, H. B. T. .	July 4, 1880	R. McFarlane .....	R. McFarlane .....	.....do.
3406	.....	.....	.....	Repulse Bay .....	Spring, 1884	Dr. J. Rao .....	Dr. J. Rao .....	.....do.
6333	.....	.....	.....	Anderson River, north of Bear Lake.	.....	R. McFarlane .....	R. McFarlane .....	.....do.

TABLE XCIV.—List of specimens examined of SPERMOPHILUS EMPETRA var. EMPETRA—Continued.

Catalogue-number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
5636		1143	...	Anderson River, north of Bear Lake.		R. McFarlane	R. McFarlane	Skin.
5531				do		do	do	do
5539				do		do	do	do
5595		1408		do		do	do	do
5641		1136		Fort Good Hope		do	do	do
5408		1194		do		do	do	do
5640	4805	1136		do		do	do	Skin & skull.
5634		1070		Fort Liard		R. R. Ross	W. L. Hardesty	Skin.
5647	4	♂	♂	Onion River	July 13, 1890	R. McFarlane	R. McFarlane	do
5649	6	♂	♂	do	July 14, 1890	do	do	do
5648	5	♀	♀	do	July 13, 1890	do	do	do
7070	385	♂	♂	Franklin Bay	June 28, 1861	do	do	do
5668		1177		(?)		do	do	do
8111		30	♂	Fort Anderson, northwest of Great Bear Lake	June 3, 1863	do	do	do
8119			♀	do	June 3, 1863	do	do	do
8114				do	June 3, 1863	do	do	do
5535				do		do	do	do
5527		1408		do		do	do	do
5534				do		do	do	do
8113		896	♂	do	June 28, 1863	do	do	do
8110		1261	♂	do	Aug. 2, 1863	do	do	do
8109		1260	♂	do	Aug. 2, 1863	do	do	do
5575		1800	♀	Fort Yukon	June 3, 1861	R. Kennicott	R. Kennicott	do
5518		1173	♀	do	June 3, 1861	do	do	do
7079		1511		do	June 3, 1861	do	do	do
5514		1536		do	May —, 1861	do	do	do
7518		1495		do	Aug. 1, 1861	do	do	do
7077		1518		do	June —, 1861	do	do	do
6580		1528		do	July —, 1861	do	do	do
6541		1516		do	June —, 1861	do	do	do
6517		1536		do	May —, 1861	do	do	do
6545		1530		do		do	do	Skull.
6546		1531		do		do	do	do
6547		1533		do		do	do	do
6548		1534		do		do	do	do
6536		1569		do		do	do	do
7080		1510		Yukon River, mouth of Porcupine River, Ft. Yukon.	June —, 1861	do	do	Skin.
7075		1514		do	June —, 1861	do	do	do
7076		1525		do	May —, 1861	do	do	do
		1523		do		do	do	do
6563		1534		800 miles S. W. of Yukon		do	do	do
6564		1535		do		do	do	do
7073		1527		do	June —, 1861	do	do	do
7074		1526		do	June —, 1861	do	do	do
6523				Fort Yukon	May —, 1861	do	do	do
8732				do	May —, 1861	do	do	do

\* Black.

TABLE XCV.—List of specimens examined of *Arctomys EMPETRA* var. *KODIACENSIS*.

Catalogue number.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
9358	Kodiak .....	Sept. 12, 1898	F. Blachoff .....	F. Blachoff .....	Sk/s.
9359	do .....	Sept. 12, 1898	do .....	do .....	do.
9360	do .....	Sept. 12, 1898	do .....	do .....	do.
9361	do .....	Sept. 12, 1898	do .....	do .....	do.
9362	do .....	Sept. 11, 1898	do .....	do .....	do.
9366	do .....	Sept. 12, 1898	do .....	do .....	do.
9367	do .....	Sept. 12, 1898	do .....	do .....	do.
9368	do .....	Sept. 12, 1898	do .....	do .....	do.
9369	do .....	June —, 1898	do .....	do .....	do.

TABLE XCVI.—List of specimens examined of *Spermophilus EMPETRA* var. *ENYTHROGLUTEUS*.

Catalogue number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
5677	6988	460	♀	Head of Flat Head R.	Sept. 7, 1890	A. Campbell .....	Dr. C. B. R. Kennerly	Skin and skull.
5680	6987	461	♀	do .....	Sept. 7, 1890	do .....	do .....	do.
5149	4900		♀	Kootenay River .....	July —, 1890	do .....	do .....	do.
5944	4901		♂	do .....	July —, 1890	do .....	do .....	do.
11987				Upper end Plover Bay.		Capt. C. M. Scammon	Capt. C. M. Scammon	Alcoholic.

**SPERMOPHILUS RICHARDSONI** (Sabine) Rich.**Richardson's Spermophile.****Var. RICHARDSONI.**

*Arctomys richardsoni* SABINE, Trans. Linn. Soc. xlii, 1892, 589, pl. xxviii; Narrative Franklin's Journey, 1822, 662.—HARLAN, Faun. Am. 1825, 168 (from Sabine).—GODMAN, Am. Nat. Hist. ii, 1896, 111 (from Sabine).—H. SMITH, Griffith's Cuvier's Anim. King. v, 1897, 246 (from Sabine).—WAGNER, Schreber's Säuget. v, pl. oex, B (no text).

*Arctomys (Spermophilus) richardsoni* RICHARDSON, Faun. Bor.-Am. i, 1899, 164, pl. xi.

*Spermophilus richardsoni* "F. CUVIER, Suppl. Buffon, i, Mamm. 1831, 331".—WAGNER, Suppl. Schreber's Säuget. iii, 1843, 243 (compiled).—AUD. & BACH. Quad. N. Am. i, 1843, 37, pl. i.—BRANDT, Bull. Classe Physico-math. Acad. Imp. Sci. St. Pétersb. ii, 1844, 279.—SCHINZ, Syn. Mamm. ii, 1845, 66.—GIEBEL, Säuget. 1855, 636 (compiled).—BAIRD, Mamm. N. Am. 1857, 325.—ALLEN, Bull. Essex Institute, vi, 1874, 61 (Western Wyoming).—GRINNELL, Ludlow's Black Hills of Dakota, 1875, 61.—COUES, Amer. Nat. ix, 1875, 148 (biographical).

*Spermophilus richardsoni* var. *richardsoni* ALLEN, Proc. Bost. Soc. Nat. Hist. xvi, 1874, 292.

**Var. TOWNSENDI.****Townsend's Spermophile.**

*Arctomys (Spermophilus) guttatus?* RICHARDSON, Faun. Bor.-Am. i, 1899, 162; Zool. Beecher's Voy. Mam. 1830, 8 (banks of the Columbia, and New Caledonia, on the mountains).—SCHINZ, Syn. Mamm. ii, 1845, 66 ("Rocky Mountains"!).

- Spermophilus guttatus* GIBBEL, *Silaget.* 1855, 634 (in part; only the American references).  
*Spermophilus townsendi* BACHMAN, *Journ. Acad. Nat. Sci. Phila.* viii, 1839, 61; TOWNSEND'S *Narrative*, 1839, 316.—AUDUBON & BACHMAN, *Quad. N. Amer.* iii, 1863, 296, pl. cxlvii, fig. 1.—BAIRD, *Mamm. N. Amer.* 1857, 326.—HAYDEN, *Trans. Amer. Phil. Soc. Phila.* xii, 1863, 145.—MERRIAM, *U. S. Geol. Surv. Terra.* 6th Ann. Rep. 1873, 664.  
*Spermophilus townsendi* var. *townsendi* ALLEN, *Proc. Bost. Soc. Nat. Hist.* xvi, 1874, 293.  
*Spermophilus elegans* KENNICOTT, *Proc. Acad. Nat. Sci. Phila.* 1863, 155.—COOPER, *Proc. Cal. Acad. Sci.* iv, 1866, 4 (Salt Lake, Utah, to Johnson's Pass, Sierra Nevada).  
*Spermophilus richardsoni* var. *elegans* ALLEN, *Proc. Bost. Soc. Nat. Hist.* xvi, 1874, 292.  
*Spermophilus armatus* KENNICOTT, *Proc. Acad. Nat. Sci. Phila.* 1863, 158.

**SPECIFIC CHARs.**—Length to base of tail 7.00 to 9.50; of tail-vertebræ 2.25 to 3.50; of tail to end of hairs 3.50 to 4.50. General color above, yellowish-brown, varying on the one hand to grayish and on the other to dusky, with or without rather distinct small light and dark spots; sides fulvous, varying to brownish; beneath, grayish-white, washed faintly with fulvous, varying to strong rust-yellow or tawny. Tail above darker than the back, edged with whitish; beneath, generally brownish-yellow, with a partly concealed subterminal black band. Ears small, pointed, one-sixth to one-fourth of an inch high. Tail short, flattened, generally more or less bushy, but sometimes quite terete; nose short and broad; general form rather thick and stout; pelage fine and soft. Varies in size and color with locality, becoming smaller and darker southward, with larger ears.

**Var. RICHARDSONI.**

*Richardson's Spermophile.*

**VARIETAL CHARs.**—Length of head and body 8.50 to 9.00, ranging from about 8.00 to 9.50; of tail to end of vertebræ 3.00 to about 3.50; of tail to end of hairs 3.75 to about 4.50. Above, light yellowish-brown, varied with dusky, generally indistinctly mottled with pale tawny and dusky; sides of the body, nose, outer side of limbs, and buttocks pale rusty-yellow; beneath, yellowish-white, varying from white, faintly washed with pale fulvous, to deep tawny; paler on the throat and middle of the breast. Tail gray, varied with black above, bright tawny or brownish-yellow below, with a partly concealed bar of black near the end, edged both above and below with yellowish-white. The hairs of the sides of the tail are crossed by a single broad bar of black, which increases in width toward the end of the tail. There is also usually a narrow bar of black at the extreme base of the hairs.

A series of nearly sixty specimens of this variety, collected in summer (July and August) by Dr. Coues at different points along the 49th parallel,

between Pembina and the Rocky Mountains, shows a considerable range of color variation. It is, however, mainly individual, the variation occurring at the same locality, covering nearly the whole range of variation presented by the whole series. The differences consist mainly in the distinctness of the mottling above and in the amount of fulvous pervading the general coloration. In No. 11956, from Frenchman's River, the general color above is gray, the light spots being almost white; the sides, especially posteriorly, incline to brownish; the lower surface is grayish-white, with a very slight but distinct tinge of fulvous. Another (No. 11963), from the same locality, is still whiter below, with a rather browner cast above, wholly unvaried by spotting. Still another (No. 11954), also from the same locality as the others, is decidedly reddish-brown, more varied with dusky above, while otherwise not different from the last. Others differ from these in being strongly fulvous beneath, with a more yellowish cast above. These can all be nearly matched by others from the Milk River series, collected some two hundred miles further west. The specimens most strongly suffused with tawny are from the Two Forks of Milk River and the Three Buttes, these averaging more fulvous than specimens from further eastward. Nos. 11975 (Three Buttes), 11953 (Two Forks of Milk River), and 11945 (Milk River at 49°) present a strong contrast with the pale phase already described, the lower surface being quite bright rusty-yellow. Between these extremes there is, however, almost every conceivable intermediate stage.

Var. TOWNSENDI.

*Townsend's Spermophile.*

VARIETAL CHARS.—Smaller than var. *richardsoni*, with larger ears and much darker coloration. Length of head and body 6.75 to 8.50; of tail to end of vertebrae 2.10 to 3.50; to end of hairs 3.35 to 4.60. Above, finely varied with yellowish-gray and black, with generally a slight wash of dark reddish-brown along the middle of the back and very indistinctly mottled; below, grayish-white, tinged more or less with brownish-yellow. Top of the nose, ears, outer side of the fore and hind limbs, and buttocks reddish-brown, often in striking contrast with the general coloration; tail mostly black above, edged with yellowish-white. The hairs individually, especially the lateral ones, are barred successively with black, the outer bar being very broad and edged with yellowish-white.

This variety is also represented by a large *suite* of specimens from a con-



siderable number of localities, through which its complete intergradation with the larger, paler, and more fulvous form of the north is clearly shown. In its extreme phase, var. *townsendi* is widely different in color from var. *richardsoni*, yet the extreme phases of differentiation are intimately and inseparably connected. There is, likewise, a wide range of individual variation, as shown by the Camp Carling and Fort Bridger series, not only in respect to coloration, but in the size of the ears and the length of the tail, as is also the case in var. *richardsoni*.

In No. 3378, from Fort Bridger, the general color above is decidedly blackish, varied with pale yellowish-brown. No. 3374 is less black, and is strongly washed with pale reddish-brown. No. 3370 is more grayish, but still largely varied with black and more faintly washed with pale reddish-brown. The darkest phase represents the *S. armatus* of Kennicott, while the lighter is his *S. elegans*, as shown by his types. Others, from the same localities as the above, showing a tendency to small indistinct quadrate spots, are his *S. townsendi*. Between these is every possible shade of intergradation. With the greater duskiness of the general color of the dorsal surface, the prevailing color of the tail is black, both above and below. There is generally a distinct basal bar of black in addition to the broad outer one, which, in the northern form, is but faintly indicated. The darkest specimen is one from Soda Springs, Oreg., which is nearly black above, profusely and finely mottled with yellowish-gray. The tail is dark ochrey-brown and black, edged with whitish-gray. The skull is not different in size or other characters from average adult examples from other localities further eastward.

In both this variety and var. *richardsoni*, the tail-vertebræ alone vary fully an inch in length. In the table of measurements, the northern form appears to have much the longer tail; but the series of over sixty specimens of var. *richardsoni* shows that in the average there is no material difference in respect to this character in the two forms. Many of the northern specimens have tails as short as any of the southern examples, while some of the southern specimens have tails as long as the longest northern-tailed examples. A part of the apparent difference in respect to the length of the tail as given in the tables is perhaps due to different methods of measurement.

GENERAL REMARKS RESPECTING SPERMOPHILUS RICHARDSONI AND ITS VARIETIES.

DIFFERENTIAL CHARACTERS AND AFFINITIES.—*Spermophilus richardsoni* approaches quite nearly in size to *S. franklini*, but, in color, proportions, and



texture of the pelage, the two are entirely distinct, and, as respects the form of the skull, are almost at the opposite extremes of the genus. In coloration, *S. richardsoni*, as represented in some phases of var. *townsendi*, makes a close approach to *S. mollis*, so that half-grown specimens of the former, in a bad state of preservation, might be distinguished with difficulty from *S. mollis*. The two species are, however (as will be shown later), radically different. *S. richardsoni* hence has no very intimately allied American affine. Its relationship to some of the *Spermophiles* of the Old World seems to be somewhat closer than to any American species. The coloration of the mottled phase of var. *townsendi* somewhat resembles that of *S. guttatus*, to which it was referred by Richardson and subsequently by other authors, on the ground of Richardson's description. Audubon and Bachman state that they compared a specimen of their *S. townsendi* with specimens of *S. guttatus* in the Berlin Museum, and found that though there was "a general resemblance" between them, they were "scarcely more alike than the Red Squirrel of Europe (*Sciurus vulgaris*) and the Red Squirrel of America (*Sciurus hudsonius*)". They add:—"They may be distinguished from each other at a glance by the large rounded spots on the back of the Russian animal, compared with the white and irregular specks in the American species." Two examples of *S. guttatus* now before me seem to fully bear out this latter statement.

*S. richardsoni* presents a wide range of geographical variation, but can be only rather arbitrarily subdivided into geographical races or subspecies. Northern specimens are not only considerably larger than southern ones, but are much more fulvous, with a minimum amount of black, and smaller ears. The southern form, as contrasted with the northern, is not only smaller, but the fulvous suffusion of the northern type is replaced by a reddish- or ochrey-brown tint, and there is a great accession of black above, and especially in the tail. This form is developed in its most strongly differentiated phase in the region where also occurs the *richardsoni* type of *Sciurus hudsonius*, a reddish-brown phase of *Tamias asiaticus*, and the smaller dark phase of *Spermophilus empetra*.

The Pembina specimens, as well as all of those collected thence westward to the Rocky Mountains, agree perfectly with Sabine's and Richardson's descriptions of *S. richardsoni*, based on specimens from localities much further north. The specimens from along the forty-ninth parallel are the palest of any before me; others, however, from Fort Ellis, Montana, and from

Central Dakota, are quite similar, but are rather more strongly colored. These lead into the Camp Carling series and those from the North Platte (vicinity of the Medicine Bow Mountains), which are considerably darker, but among which are specimens almost undistinguishable from the more northern type. In the Camp Carling and Wind River Mountain specimens, the black annulations in the hairs of the upper surface begin to increase in extent, with a larger proportion of hairs wholly black, and a somewhat stronger wash of rufous over the middle of the back, while the fulvous tint of the sides becomes also more brownish. In the Fort Bridger specimens, the ear becomes still further enlarged; the black tips of the hairs are still longer and more conspicuous, in extreme examples (as Nos. 3372 and 3378) giving a strongly blackish cast to the whole dorsal surface; the lighter annulations become correspondingly narrower, and constitute merely a fine gray mottling. In other specimens, there is a nearly equal admixture of the dark and light shades, resulting in a uniform finely grizzled tint (as in No. 3320), with a faint wash of pale rufous, varying in some specimens to dull chestnut. In this phase (*S. "armatus"* Kennicott), the hairs of the dorsal surface are black at the base, then crossed by a broad bar of whitish, succeeded by another of pale rufous, extending nearly to the tips, which are shining black. The light subterminal bar varies from gray on the head, over the shoulders, and on the sides to pale rufous on the middle of the back. The nose and buttocks are usually strongly rufous. In var. *richardsoni*, there is a much broader subbasal zone of white, occupying generally two-thirds of the length of the hair; the dark rings are not so black, and the fulvous tipping is much paler.

SYNONYMY AND NOMENCLATURE.—*Spermophilus richardsoni* was first described and figured by Sabine, in 1822, from a specimen collected at Carlton House. Richardson gave a more detailed account of it in 1829. It was also described by Wagner, Audubon and Bachman, Baird, and others, who added, however, little to its history. Dr. Coues, in 1875, published an excellent account of its habits, and contributed much to our knowledge of its distribution. These descriptions, as well as various compiled accounts, relate almost wholly to the northern form, above characterized as var. *richardsoni*. Richardson, however, as early as 1829, in the Fauna Boreali-Americana, described what is here recognized as var. *townsendi*, he referring it doubtfully to the *guttatus* of Pallas and Temminck, which is an allied species of Siberia.

Richardson's "*Arctomys (Spermophilus) guttatus?*" was based on specimens from the western slope of the Rocky Mountains, obtained by Mr. Douglass. As late as 1839, he had not satisfied himself of its distinctness from the Old World *S. guttatus*, at which date he referred to it as inhabiting the "banks of the Columbia and New Caledonia, on the mountains".\* In 1839, Bachman described his *Spermophilus townsendi* from specimens obtained "near Walla-Walla" in Oregon, by Mr. Townsend, Bachman at this time regarding it as distinct from both *S. richardsoni* and Richardson's *guttatus*. In 1853, however, he considered it as identical with the *guttatus* of Richardson, which he had satisfied himself was distinct from the Siberian *guttatus* of Pallas and Temminck. *S. townsendi* was redescribed by Baird in 1857, from one of Bachman's specimens, under the same name. In 1858, Mr. Drexler collected a suite of some thirty specimens in the vicinity of Fort Bridger, Utah. These Mr. Robert Kennicott later referred in part to *S. townsendi* and in part to his *S. elegans* and *S. armatus*, described by him as new species in 1863. Since this date, a large number of specimens have been brought in by different collectors from various localities in Wyoming, Montana, and Dakota, which serve to throw much light upon the relationship of these several supposed species, and show beyond question that all are specifically referable to *S. richardsoni*, though differing, as already shown, quite widely from the northern type of this animal, as described by Sabine and Richardson. As already detailed, *S. richardsoni*, as represented in the United States, within and to the westward of the Rocky Mountains, is smaller, much darker colored, and otherwise different from the *S. richardsoni* of Sabine. The abundant material now at command (embracing nearly one hundred and fifty specimens) shows also a wide range of individual variation, and that the *S. "elegans"*, *S. "armatus"*, and *S. "townsendi"* refer respectively merely to the light, dark, and mottled phases of one and the same animal, all of which occur at the same locality. Three years since, I was myself led by immature specimens from near the original locality of *S. townsendi* to confound *S. townsendi* with the smaller and entirely distinct *S. mollis*.†

\* Zool. of Beechey's Voy. p. 7.

† That Bachman's *S. townsendi* is not the *S. mollis* of Kennicott is evident from its large size, Bachman giving the length of his *S. townsendi* as 8.75, exclusive of the tail. I have recently received from Captain Charles Beudire a specimen of a *Spermophile*, from near Camp Harney, that agrees in size and coloration with Bachman's *S. townsendi*. The corresponding measurements of two specimens of Richardson's "*guttatus?*" are 8.50 and 9.50. These authors both refer to the very small size of the ear in their

GEOGRAPHICAL DISTRIBUTION.—The exact limits of the range of *S. richardsoni* still remain unknown. Richardson gives its range as not extending beyond latitude  $55^{\circ}$ ,\* and as being a common inhabitant of the plains between the north and south branches of the Saskatchewan River. Along the forty-ninth parallel, it occurs, according to Dr. Cones, abundantly as far eastward as the Pembina Mountains,† and is common thence westward to the Rocky Mountains. It occurs southward along the James River to its sources, and probably throughout the more northern portions of the Territories to the westward.‡ There are numerous specimens in the National Museum from various localities in Western Montana, Western Wyoming, Northern Utah, and Eastern Oregon. It is also reported by Richardson from the western slope of the Rocky Mountains north of the forty-ninth parallel. The most southern localities represented are the Laramie Plains and the Medicine Bow Mountains.

Var. *richardsoni* is quite typically represented for some distance south of the forty-ninth parallel, in Dakota and Montana; but more to the southward and westward, including Southern Montana, Western Wyoming, and thence westward, it gives place to var. *townsendi*.

examples, an apparent objection to referring these names to any form of *S. richardsoni*; but I find in many of the specimens of var. *richardsoni* that the ear is so shrivelled and rolled down as to appear to be merely a thickened rim rather than a distinct auricle; yet, in other respects, the specimens are not different from those in which the ear is prominent. The specimens having the ears closely rolled would be naturally described as having the ear obsolete.

\* His reference in Franklin's Journey (p. 662) to its occurrence on the "shores of the Arctic Sea" he afterward states to be incorrect.—(*Fauna Bor.-Amer.* vol. 1, p. 165.)

† Professor Baird refers to a "very imperfect skin of a *Spermophile*" obtained "on an island in the Sault Ste. Marie, Michigan", which he says "approaches very closely to this species", but adds that the specimen is not in a condition to admit of a satisfactory description. Its claws are referred to as being more Sciurine in character than those of *S. richardsoni*. An examination of this very poorly preserved and imperfect specimen satisfies me that it is referable to *Sciurus hudsonius*. It presents, however, an abnormal condition of pelage.

‡ Referring to the distribution of this species near the forty-ninth parallel, Dr. Cones observes:—"Speaking generally, they extend from the Red River of the North westward to the Rocky Mountains. Baird [see preceding foot-note] speaks of their occurrence in Michigan; but I have never seen any in Minnesota, nor indeed in the immediate valley of the Red River, even on the Dakota side. There the genus is represented by *Spermophilus franklini* and *S. tridecemlineatus*. But they appear in abundance just as soon as, in passing westward, we cross the low range of the Pembina Mountains, and strike perfect prairie, characterized by the presence of such birds as Sprague's Lark, and Baird's and the Chestnut-collared Buntings. From this point they stretch clear away to the Rocky Mountains, subsiding only among the foot-hills of the main range, where the Pocket Gophers (species of *Thomomys*) begin to claim the soil: but a day's march, indeed, from the rocky haunts of the Little Chief Haro (*Lagomys princeps*). The region of the Milk River and its tributaries, most of which, as well as the river itself, cross  $49^{\circ}$ , is their centre of abundance."—(*Amer. Nat.* vol. ix, 1875, pp. 140, 150.)

TABLE XCVII.—Measurements of sixteen specimens of *SPERMOPHILUS RICHARDSONI* var. *RICHARDSONI*.

Catalogue number.	Original number.	Locality.	Sex.	From tip of nose to—				Tail to end of—		Length of—		Height of ear.*	Measure of specimen.
				Eye.	Ear.	Occiput.	Tail.	Vertebrae.	Hairs.	Fore foot.	Hind foot.		
11935	4901	Frenchman's River, Mont. Ter.	♂	0.80	1.75	3.25	9.00	3.75	4.35	1.30	1.80	.....	Fresh.
11950	4909	do.	♂	0.75	1.70	3.10	7.90	3.90	3.75	1.20	1.70	.....	do.
11954	4903	do.	♀	0.80	.....	3.70	8.50	3.70	3.75	1.30	1.60	.....	do.
11940	4106	Near mouth of Milk River, Mont. Ter.	.....	0.90	1.80	3.10	8.25	2.50	3.75	1.15	1.50	.....	do.
11976	4325	Three Buttes, Mont. Ter.	♀	0.75	1.75	3.30	8.35	3.00	4.00	1.20	1.75	.....	do.
11969	4374	do.	♂	0.95	1.75	3.19	8.50	3.00	3.25	1.20	1.75	.....	do.
11999	4330	do.	♀	0.75	1.75	3.30	9.00	3.50	3.50	1.25	1.75	.....	do.
11525	.....	Turtle Mountain, Dak. Ter.	♂	0.90	1.75	3.10	9.00	4.00	5.00	1.30	1.70	0.15	.....
11596	.....	.....do.....	♂	0.78	1.70	3.00	7.95	3.75	4.75	1.15	1.75	0.19	.....
11599	.....	35 miles east of Turtle Mountain.	♂	0.90	1.70	3.00	7.75	3.25	4.35	1.30	1.65	0.14	.....
11594	.....	do.	♂	0.90	1.75	3.00	8.00	3.50	4.50	1.30	1.65	0.19	.....
11598	.....	do.	♂	0.90	1.60	1.85	7.75	3.50	4.25	1.27	1.53	0.30	.....
11527	.....	75 miles west of Pembina Mountains.	♂	0.95	1.90	3.10	9.50	3.00	4.50	1.30	1.85	0.13	.....
11530	.....	do.	♂	0.90	1.70	3.00	9.00	3.50	4.50	1.28	1.65	0.19	.....
11531	.....	do.	♀	0.90	1.70	1.90	8.35	3.00	4.00	1.30	1.60	0.15	.....
11583	.....	La Rivière Lac, Dak. Ter.	♂	.....	.....	.....	9.00	3.50	4.50	1.27	1.52	0.17	.....

\* The measurements of the ear were taken from the skin.

† Taken from the skin.

TABLE XCVIII.—Measurements of eight specimens of *SPERMOPHILUS RICHARDSONI* var. *TOWNSENDI*.

Catalogue-number.	Locality.	Sex.	From tip of nose to—				Tail to end of—		Length of—		Height of ear.	Measure of specimens.	Remarks.
			Eye.	Ear.	Occiput.	Tail.	Vertebra.	Hairst.	Fore foot.	Hind foot.			
5857	Fort Bridger.....	♀	0.78	1.38	1.75	7.25	3.50	3.57	1.00	1.50	0.94	Alcohol.	" <i>S. elegans</i> ."
5851	.....do.....	♂	0.80	1.49	1.64	7.25	3.25	3.40	1.05	1.53	0.36	.....	do.
5853	.....do.....	♂	0.75	1.38	1.65	7.00	3.30	3.35	1.05	1.53	0.30	.....	do.
5856	.....do.....	♂	0.78	1.35	1.75	6.70	3.10	.....	0.97	1.55	0.34	.....	do.
5858	.....do.....	♂	0.61	1.40	1.65	6.75	3.50	.....	.....	.....	0.30	.....	do.
5856	.....do.....	♀	0.75	1.50	1.78	7.50	3.30	3.35	1.05	1.60	0.90	.....	" <i>S. armatus</i> ."
5859	.....do.....	♀	0.80	1.60	2.10	8.25	3.25	3.50	1.10	1.60	0.95	.....	do.
5860	.....do.....	♂	0.85	1.50	1.65	7.90	3.15	.....	1.05	1.58	0.25	.....	do.

TABLE XCIX.—Measurements of nine skulls of SPERMOPHILUS RICHARDSONI var. RICHARDSONI.

Catalogue number.	Original number.	Locality.	Sex.	Total length.	Greatest width.	Distance between orbits.	Nasal bones, length.	Nasal bones, width behind.	Nasal bones, width before.	Upper incisors from front to molars.	Upper incisors from front to hinder margin of palate.	Upper incisors, height.	Upper incisors, width between external edges.	Upper molars, length taken together.	Lower jaw, length.	Lower jaw, height.
0630	.....	Source of James R.	.....	1.75	1.10	0.40	0.00	0.15	.....	0.08	0.95	0.28	0.15	0.40	1.08	0.48
0631	.....	do	.....	1.60	1.15	0.42	0.00	0.18	.....	0.00	0.95	0.30	0.17	0.45	1.10	0.50
0633	.....	do	.....	1.82	1.15	0.41	0.00	.....	.....	0.51	.....	0.28	0.18	.....	1.10	.....
2308	.....	75 miles west of Pembina Mts.	♂	1.00	1.07	0.46	0.07	0.20	0.32	0.57	1.00	0.25	0.19	0.48	1.16	0.53
3310	.....	do	♂	1.78	.....	0.40	0.03	0.17	0.30	0.51	0.97	.....	.....	0.45	1.08	0.49
3749	.....	La Riviere Lee	♂	1.78	1.17	0.40	0.09	0.50	0.39	0.90	0.98	0.57	0.18	0.40	1.06	0.55
3345	.....	Turtle Mt.	♂	1.60	.....	0.37	0.07	0.17	0.30	0.55	1.03	0.90	0.20	0.45	1.15	0.50
3311	.....	25 miles east of Turtle Mt.	♂	1.68	.....	0.36	0.05	.....	.....	.....	.....	.....	.....	.....	1.08	0.49
3118	.....	do	♂	1.78	.....	.....	0.00	0.18	.....	0.51	0.95	.....	.....	.....	1.05	0.53

TABLE C.—Measurements of thirteen skulls of SPERMOPHILUS RICHARDSONI var. TOWNSENDI.

Catalogue number.	Locality.	Sex.	Total length.	Greatest width.	Distance between orbits.	Nasal bones, length.	Nasal bones, width behind.	Nasal bones, width before.	Upper incisors from front to molars.	Upper incisors from front to hinder margin of palate.	Upper incisors, height.	Upper incisors, width between external edges.	Upper molars, length taken together.	Lower jaw, length.	Lower jaw, height.
4414	Fort Bridger, Utah	.....	1.65	1.05	0.36	0.53	0.16	0.30	0.41	0.26	0.20	0.15	0.36	0.98	0.48
3268	do	♀	.....	.....	.....	0.60	.....	.....	0.45	0.89	.....	.....	.....	.....	.....
4780	do	.....	1.85	1.30	0.46	0.70	0.17	0.36	0.55	0.95	0.26	0.20	0.40	1.14	0.48
4797	do	.....	1.85	1.18	0.45	.....	.....	.....	.....	.....	.....	.....	0.40	1.15	0.58
4794	do	.....	.....	.....	.....	.....	.....	.....	0.46	0.80	.....	.....	0.38	1.02	.....
4808	do	♂	.....	.....	.....	0.70	0.18	0.30	0.50	0.97	.....	.....	.....	.....	.....
4809	do	.....	1.80	1.30	0.40	0.66	.....	.....	0.54	0.96	.....	.....	.....	1.19	0.58
*12857	Pleasant Valley, Utah	.....	1.88	1.32	0.38	0.65	0.16	0.30	0.57	1.03	0.30	0.17	0.34	1.08	0.55
12889	Teton Canon, Utah	.....	1.80	1.16	0.40	0.61	0.15	0.28	0.48	0.98	0.23	0.17	0.37	1.07	0.51
12889	do	.....	1.68	1.06	0.40	.....	.....	.....	0.45	0.90	0.23	0.20	0.40	1.00	0.43
3304	Bridger's Pass, Rocky Mts.	.....	1.65	1.10	0.36	.....	.....	.....	0.46	0.93	0.26	0.20	0.40	1.09	0.46
4186	North Platte, Wyo. Ter.	♂	1.70	1.15	0.38	0.68	0.16	0.30	.....	.....	.....	.....	0.43	1.05	0.47
4197	Medicine Bow Mountains	♂	1.66	1.14	0.36	0.57	.....	.....	0.45	.....	0.21	0.15	0.43	.....	.....

\* Very old.

† Quite young.

TABLE CL.—List of specimens examined of *SPERMOPHILUS RICHARDSONI* var. *RICHARDSONI*.

Catalogue number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
11903	4985	♂		Milk River, at 40° Mont	July 23, 1874	A. Campbell.	Dr. E. Coes.	Skin.
11945	4984	♀		do	July 23, 1874	do	do	do.
11906	4983	♂		do	July 23, 1874	do	do	do.
11901	4937	♀		Two Forks, Milk River, Mont.	July 21, 1874	do	do	do.
11948	4238	♀		do	July 21, 1874	do	do	do.
11933	4280	♀		do	July 15, 1874	do	do	do.
11943	4225	♀		do	July 15, 1874	do	do	do.
11935	4301	♂		Frenchman's River, Mont.	July 13, 1874	do	do	do.
11934	4303	♀		do	July 13, 1874	do	do	do.
11936	4305			do	July 10, 1874	do	do	do.
11937	4174			do	July 9, 1874	do	do	do.
11900	4308			do	July 10, 1874	do	do	do.
11939	4309	♂		do	July 10, 1874	do	do	do.
11938	4175			do	July 9, 1874	do	do	do.
11932	4178	♂		do	July 9, 1874	do	do	do.
11986	4305			do	July 10, 1874	do	do	do.
11946	4313	♀		do	July 10, 1874	do	do	do.
11950	4304	♀		do	July 10, 1874	do	do	do.
11940	4106			Near mouth of Milk River.	June 30, 1874	do	do	do.
11967				Wolf River, Mont.	July 28, 1874	do	do	do.
11904	4688	♂		Chief Mountain, 40° N	Aug. 28, 1874	do	do	do.
11387	3308	♂		75 miles west of Pembina Mts.	July 17, 1873	do	do	Skin and skull.
11330	3309	♂		do	July 17, 1873	do	do	do.
11331	3310	♀		do	July 17, 1873	do	do	do.
11584	3311	♂		25 miles east of Turtle Mt.	July 18, 1873	do	do	do.
11539	3319	♂		do	July 18, 1873	do	do	do.
11588	3313	♂		do	July 18, 1873	do	do	do.
11585	3345	♂		Turtle Mountain, Dak	July 23, 1873	do	do	do.
11596	3357	♂		do	July 23, 1873	do	do	do.
11593	3740	♂		La Rivière Lac, Dak	Sept. 13, 1873	do	do	do.
11970	4313	♀		Three Buttes, Mont.	Aug. 13, 1874	do	do	Skin.
11979	4326	♀		do	Aug. 6, 1874	do	do	do.
11941	4407	♂		do	Aug. 13, 1874	do	do	do.
11908	4430	♂		do	Aug. 13, 1874	do	do	do.
11969	4418	♂		do	Aug. 13, 1874	do	do	do.
11938	4408	♂		do	Aug. 13, 1874	do	do	do.
11901	4374	♂		do	Aug. 9, 1874	do	do	do.
11980	4406	♂		do	Aug. 13, 1874	do	do	do.
11977	4421	♂		do	Aug. 13, 1874	do	do	do.
11968	4430	♂		do	Aug. 13, 1874	do	do	do.
11951	4375	♀		do	Aug. 9, 1874	do	do	do.
11973	4391	♂		do	Aug. 10, 1874	do	do	do.
11971	4416	♂		do	Aug. 13, 1874	do	do	do.
11949	4410	♀		do	Aug. 13, 1874	do	do	do.
11976	4383	♀		do	Aug. 6, 1874	do	do	do.
11974	4336			do	Aug. 9, 1874	do	do	do.
11978	4419	♂		do	Aug. 13, 1874	do	do	do.
11927	4411	♂		do	Aug. 13, 1874	do	do	do.
11939	4390	♀		do	Aug. 10, 1874	do	do	do.
11972	4409	♀		do	Aug. 13, 1874	do	do	do.
11947	4417	♂		do	Aug. 13, 1874	do	do	do.
11944	4415			do	Aug. 13, 1874	do	do	do.



TABLE CI.—List of specimens examined of SPERMOPHILUS RICHARDSONI var. RICHARDSONI—Continued.

Catalogue-number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
11050	4413	♀	Three Buttes, Mont. ....	Aug. 14, 1874	A. Campbell ...	Dr. E. Coues ...	Skin.	
11075	4414	♂	do	Aug. 14, 1874	do	do	do.	
8483	6631	♂	Source of the James R., Dak.	July 26, 1885	General Sully ...	S. M. Rothhammer	Skin and skull.	
8485	6630	♂	do	July 26, 1885	do	do	do.	
8484	6638	♂	do	July 27, 1885	do	do	do.	
8486	668	♂	do	July 27, 1885	do	do	Skin.	

TABLE CII.—List of specimens examined of SPERMOPHILUS RICHARDSONI var. TOWNSENDI.

Catalogue-number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
3791	.....	.....	.....	Walla-Walla, Oreg. ....	.....	U. S. Es. Exped. ....	T. H. Peale.....	Skin.
5316	.....	.....	.....	Soda Springs, Oreg. ....	Aug. 23, 1879	Capt. Chas. Bendire	Capt. Chas. Bendire	Skin and skull.
3775	.....	154	♂	Camp Floyd, Utah T. ....	Mar. 9, 1880	Capt. J. H. Simpson	C. S. McCarthy....	Skin.
3368	4796	166	♀	Fort Bridger, Utah T. ....	Apr. 11, 1880	W. M. F. McGraw ..	C. Drexler.....	Skin and skull.
3360	.....	160	♀	do .....	Apr. 11, 1880	do .....	do .....	Skin.
3373	4799	.....	♂	do .....	Apr. 11, 1880	do .....	do .....	Skin and skull.
3373	.....	166	♂	do .....	Apr. 11, 1880	do .....	do .....	Skin.
3370	4810	233	♀	do .....	Apr. 17, 1880	do .....	do .....	Skin and skull.
3380	.....	46	♂	do .....	Apr. 14, 1880	do .....	do .....	Skin.
3380	4804	.....	.....	do .....	.....	do .....	do .....	Skin and skull.
3383	4800	454	♀	do .....	—, 1880	do .....	do .....	do.
3364	.....	736	♀	do .....	June 25, 1880	do .....	do .....	Skin.
3366	.....	610	♂	do .....	June 10, 1880	do .....	do .....	do.
3367	.....	261	♂	do .....	May 2, 1880	do .....	do .....	do.
3370	.....	455	♀	do .....	May 20, 1880	do .....	do .....	do.
3372	.....	167	♂	do .....	Apr. 11, 1880	do .....	do .....	do.
3376	.....	920	♀	do .....	Apr. 15, 1880	do .....	do .....	do.
3378	.....	140	♂	do .....	Apr. 2, 1880	do .....	do .....	do.
3381	.....	375	♂	do .....	May 19, 1880	do .....	do .....	do.
4281	4704	.....	.....	do .....	Oct. 20, 1880	do .....	do .....	Skin and skull.
4687	.....	♀	do	do .....	do .....	do .....	do .....	Alcoholic.
4681	.....	♂	do	do .....	do .....	do .....	do .....	do.
4683	.....	do	do	do .....	do .....	do .....	do .....	do.
4684	.....	do	do	do .....	do .....	do .....	do .....	do.
4685	.....	do	do	do .....	do .....	do .....	do .....	do.
4686	.....	♂	do	do .....	do .....	do .....	do .....	do.
4687	.....	♀	do	do .....	do .....	do .....	do .....	do.
4688	.....	do	do	do .....	do .....	do .....	do .....	do.
4689	.....	♀	do	do .....	do .....	do .....	do .....	do.
11104	13280	16	.....	Teton Canon .....	July 20, 1872	Dr. F. V. Hayden ..	C. H. Merriam .....	Skin and skull.
11105	13260	18	.....	do .....	Aug. 1, 1872	do .....	do .....	do.
11110	.....	19	.....	do .....	Aug. 1, 1872	do .....	do .....	Skin.
11112	.....	94	♂	Henry's Fork .....	Aug. 9, 1872	do .....	do .....	do.
9854	.....	9	.....	Pleasant Valley, Utah.	June 20, 1871	do .....	F. J. Huse .....	do.



TABLE CII.—List of specimens examined of *SPERMOPHILUS RICHARDSONI* var. *TOWNSENDI*—Continued.

Catalogue-number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
9830	13257	.....	.....	Pleasant Valley, Utah	.....	Dr. F. V. Hayden	F. J. Hase	Skin and skull.
4598	.....	63	.....	Wind River Mountains	.....	do	Dr. F. V. Hayden	Skin.
4285	.....	49	.....	do	June 1, 1880	do	do	do.
4203	.....	84	.....	do	June 4, 1880	do	do	do.
4289	.....	87	.....	do	June 4, 1880	do	do	do.
4291	.....	.....	.....	do	June 1, 1880	do	do	do.
4286	.....	.....	.....	do	May 31, 1880	do	do	do.
5636	.....	.....	.....	do	June—, 1880	do	do	do.
9640	.....	5	.....	Camp Carling, Mont. T.	.....	do	W. T. Schmidt	do.
9641	.....	30	.....	do	.....	do	do	do.
9492	.....	94	.....	do	.....	do	do	do.
9643	.....	38	.....	do	.....	do	do	do.
9639	.....	.....	.....	do	.....	do	do	do.
3043	.....	89	.....	Bridger's Pass	July 28, 1857	Dr. W. A. Hammond	Dr. W. A. Hammond	do.
4003	.....	3	♀	Fort Bridger	.....	W. M. F. Magraw	C. Drexler	do.
5055	4814	.....	.....	do	.....	do	do	Skin and skull.
4255	.....	.....	.....	Fort Benton	.....	Gov. I. I. Stevens	Dr. Geo. Suckley	Skin.
3070	3306	343	♂	Medicine Bow Mts.	July 24, 1857	Lt. F. T. Bryan	W. S. Wood	Skin and skull.
3074	3308	338	♂	North Platte, Wyo. T.	July 28, 1857	do	do	do.
3078	3307	.....	.....	do	.....	do	do	do.
3077	364	♂	.....	Bridger's Pass	July 30, 1857	do	do	Skin.
.....	3394	365	.....	do	.....	do	do	Skull.
7014	333	♂	.....	Medicine Bow Mts.	July 25, 1857	do	do	Skin.
3076	374	♂	.....	North Platte, Wyo. T.	Aug. 3, 1857	do	do	do.
4328	.....	.....	.....	Head of Twenty-five Mile River, Nebr.	July 1, 1880	J. H. Crook	J. H. Crook	do.
3881	.....	♀	.....	Bridger's Pass	.....	Gov. I. I. Stevens	Dr. Geo. Suckley	do.
3893	.....	.....	.....	do	.....	do	do	do.
4267	.....	94	.....	Smith's Fork, Mont. T.	July 7, 1880	Dr. F. V. Hayden	Dr. F. V. Hayden	do.
9831	.....	17	.....	Fort Ellis, Mont. T.	July 11, 1880	do	F. J. Hase	do.
9830	13257	15	.....	do	July 11, 1871	do	do	Skin and skull.
9839	.....	10	.....	20 miles south of Virginia City, Mont. T.	July 1, 1871	do	do	Skin.
9853	.....	11	.....	60 miles south of Virginia City, Mont. T.	July 1, 1871	do	do	do.

## SPERMOPHILUS MOLLIS Kennicott.

## Short-tailed Spermophile.

*Spermophilus mollis* KENNICOTT, Proc. Acad. Nat. Sci. Phila. 1863, 157.*Spermophilus townsendi* var. *mollis* ALLEN, Proc. Bost. Soc. Nat. Hist. xvi, 1874, 293.

**SPECIFIC CHARs.**—Length to base of tail 6.00 to 6.50; cf tail to end of vertebrae about 1.75; to end of hairs about 2.50. Above, finely variegated pale yellowish-brown and dusky; lower parts gray, washed with pale creamy-yellow. Eyelids yellowish-white; sides of face and neck yellowish-brown; tail above, like the back, edged with whitish, and with a very indistinct dusky

subterminal band; tail below brownish-yellow, edged with whitish. Ears nearly obsolete; muzzle much compressed; tail very short, flattened. Pelage very soft and furry.

In coloration, this species somewhat resembles *S. spilosoma*, but shows no tendency to spotting. It differs from it also in its fine, soft, instead of coarse, harsh pelage, in having a very much shorter and more flattened tail, and in being rather smaller. The muzzle is also much narrower, and the auditory bullæ are much less inflated. The anterior half of the dorsal surface in *S. mollis* is uniform yellowish-brown, faintly varied with gray and dusky, with no tendency to differentiation into spots; more posteriorly, the dorsal surface tends to a mottled appearance, but the light spots are very small and indistinct. In coloration, *S. mollis* approaches very closely to some phases of *S. richardsoni* var. *townsendi*, particularly as seen in the types of Mr. Kennicott's *S. "elegans"*, but it is on the whole more yellowish, especially over the shoulders; it lacks also the brownish nose-patch, and the tendency to differentiation into spots is less marked. It differs further from var. *townsendi* in being nearly one-half smaller, in having smaller ears, a narrower and less bushy tail, and in its strongly compressed muzzle. There are also well-marked cranial differences aside from those resulting from size. Full-grown skulls of *S. mollis* give a length of only 1.45 against a length, in corresponding skulls of var. *townsendi*, of 1.85; width of the former 0.95; of the latter 1.20. The skulls of *S. mollis* have a relatively much greater interorbital breadth, while the facial portion of the skull is relatively much the narrower, with narrower and longer nasals. The zygomatic arches are also much less expanded posteriorly, giving to the skull quite a different lateral outline.

This form appears to have been first described (as above indicated) by Mr. Kennicott, in 1863, from specimens collected at Camp Floyd, Utah, and other neighboring localities. Other specimens have since been obtained in Nevada and Utah. Its exact geographical range remains unknown. It is evidently a species very distinct from its nearest allies, though it strongly resembles in coloration some phases of *S. richardsoni* var. *townsendi*, from young examples of which, as represented by badly prepared skins, it is not readily distinguishable. In my preliminary notice of these forms, I provisionally referred *S. mollis* to *S. townsendi*, but a re-examination of the subject, aided by additional material, has shown this reference to be erroneous.

TABLE CIII.—Measurements of four specimens of *SPERMOPHILUS MOLLIS*.

Catalogue-number.	Locality.	Sex.	From tip of nose to—				Tail to end of—		Length of—		Height of ear.	Nature of specimen.
			Eyes.	Nar.	Occiput.	Tail.	Vertebrae.	Hairs.	Fore foot.	Hind foot.		
4793	Spokane Plains .....	♀	0.52	1.80	1.43	5.10	1.15	1.65	0.75	1.75	0.10	Alcoholic.
4799	.....do .....	.....	0.70	1.30	1.58	6.50	1.30	2.10	0.77	1.10	0.10	.....do.
5049	.....do .....	♂	0.60	1.15	1.40	4.50	0.99	1.60	0.77	1.19	0.10	.....do.
4953	Rocky Mountains .....	♀	0.52	1.15	1.45	6.10	1.00	2.20	0.73	1.20	0.07	.....do.

TABLE CIV.—Measurements of two skulls of *SPERMOPHILUS MOLLIS*.

Catalogue-number.	Locality.	Sex.	Total length.	Greatest width.	Distance between orbits.	Nasal bones, length.	Nasal bones, width behind.	Nasal bones, width before.	Upper incisors from front to molars.	Upper incisors from front to hinder margin of palate.	Upper incisors, height.	Upper incisors, width between external edges.	Upper molars, length taken together.	Lower jaw, length.	Lower jaw, height.
4952	Rocky Mountains .....	♀	1.45	0.95	0.35	0.53	0.13	0.30	0.44	0.80	0.22	0.14	0.30	0.91	0.40
4798	Camp Floyd, Utah .....	.....	1.45	0.98	0.31	0.50	.....	.....	0.44	0.77	0.33	.....	.....	0.90	.....

TABLE CV.—List of specimens examined of *SPERMOPHILUS MOLLIS*.

Catalogue-number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
3777	4798	161	..	Camp Floyd, Utah .....	Mar. 18, 1899	Capt. J. H. Simpson	C. S. McCarthy .....	Skin and skull.
3775	.....	159	.....	.....do .....	Mar. 9, 1899	.....do .....	.....do .....	Skin.
3885	.....	71	..	Goosboot Mountains .....	May 9, 1899	.....do .....	.....do .....	.....do.
9392	.....	.....	.....	Carson Desert, Nev. ....	June —, 1898	Clarence King .....	H. Ridgway .....	.....do.
4959	5049	.....	♀	Rocky Mountains .....	.....	.....	.....	Skin and skull.
4953	.....	.....	.....	.....	.....	.....	.....	Alcoholic.
11134	.....	6	.....	Ross's Fork, Idaho Ter. ....	Sept. 3, 1873	Dr. F. V. Hayden .....	C. N. Merriam .....	Skin.
4799	.....	.....	.....	Sinjakwatom Depot .....	.....	A. Campbell .....	Dr. C. B. R. Kennerly .....	Alcoholic.
4798	.....	.....	.....	Spokane Plains .....	.....	.....do .....	.....do .....	.....do.
5049	.....	.....	.....	.....do .....	.....	.....do .....	.....do .....	.....do.

## SPERMOPHILUS TERETICAUDUS Baird.

## Fort Yuma Spermophile.

*Spermophilus tereticaudus* BAIRD, Mam. N. Amer. 1857, 315; U. S. and Mex. Bound. Survey, ii, pt. ii, 1859, 34, pl. vii, fig. 2, head and feet; pl. xxii, fig. 4, skull.—ALLEN, Proc. Bost. Soc. Nat. Hist. xvi, 1874, 291.

**SPECIFIC CHARs.**—Length of head and body about 6.00; of tail to end of vertebræ 3.60 to 4.40; to end of hairs about 4.75. Above, finely varied with yellowish-brown and gray, without distinct spots; beneath, pale brownish-white. Tail above, concolor with the back, with indistinct annulations, and a faint, subterminal, dusky bar; color below like that of the ventral surface of the body. Ears very small, nearly obsolete. Tail slender, not appreciably flattened, the vertebræ alone rather more than half the length of the head and body. Soles and muzzle densely pilose. Differs very little in general proportions from *S. mexicanus*, but is considerably smaller, its size being nearer that of *S. spilosoma*, which it almost exactly resembles in cranial characters. It differs from it radically in coloration and in its much longer and more slender tail.

The peculiar combination of characters presented by this species renders it very distinct from its nearest allies, *S. mexicanus* and *S. spilosoma*. It wholly lacks the reddish coloration and distinct white spots that characterize these species, while its tail is more terete and the general form of the body perhaps rather more slender. It is known as yet only from the specimens described by Professor Baird in his original account of the species, published twenty years ago. These were all collected at Fort Yuma, Cal., by Maj. G. H. Thomas. They consist of one skin and a skull and three examples in alcohol, all in rather bad condition.

TABLE CVL.—Measurements of three specimens of SPERMOPHILUS TERETICAUDUS.

Catalogue-number.	Locality.	Sex.	From tip of nose to—				Tail to end of—		Length of—		Height of ear.	Nature of specimen.
			Eyes.	Ears.	Occiput.	Tail.	Vertebra.	Hairs.	Fore feet.	Hind feet.		
9490	Fort Yuma, Cal.	♂	0.55	1.14	1.50	4.10	2.80	3.27	0.75	1.30	0.10	Alcoholic.
1283	do	♂	0.08	1.03	1.58	0.04	3.50	.....	0.00	1.30	.....	do.
1384	do	♂	.....	.....	1.50	5.25	4.43	4.04	.....	1.30	.....	do.

TABLE CVII.—Measurements of two skulls of *SPERMOPHILUS TERETICAUDUS*.

Catalogue-number.	Locality.	Sex.	Total length.	Greatest width.	Distance between orbits.	Nasal bones, length.	Nasal bones, width behind.	Nasal bones, width before.	Upper incisors from front to molars.	Upper incisors from front to hinder margin of palato.	Upper incisors, height.	Upper incisors, width between external edges.	Upper molars, length taken together.	Lower jaw, length.	Lower jaw, height.
9419	Fort Yuma, Cal. ....	♂	1.48	0.85	0.32	0.45	0.12	0.90	0.38	0.74	0.90	0.15	0.90	0.80	0.45
1595	.....do.....	♂	1.50	0.90	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

TABLE CVIII.—List of specimens examined of *SPERMOPHILUS TERETICAUDUS*.

Catalogue-number of skin.	Corresponding number of skull.	Sex and age.	Locality.	From whom received.	Collected by—	Status of specimen.
1534	2410	...	Fort Yuma, Cal. ....	Maj. G. H. Thomas...	Maj. G. H. Thomas...	Skin and skull.
9400	.....	♂	.....do.....	.....do.....	.....do.....	Alcoholic.
1585	.....	♂	.....do.....	.....do.....	.....do.....	.....do.....
1584	.....	♂	.....do.....	.....do.....	.....do.....	.....do.....

**SPERMOPHILUS SPILOSOMA Bennett.****Sonoran Spermophile.**

*Spermophilus spilosoma* BENNETT, Proc. Zool. Soc. i, 1833, 40 ("California").—RICHARDSON, Zool. Beechey's Voy. 1839, Mam. 12\*.—WAGNER, Suppl. Schreber's Säuget. iii, 1843, 351 (foot-note).—AUDUBON & BACHMAN, Quad. N. Am. pl. cix, folio ed.—BAIRD, Proc. Acad. Nat. Sci. Phila. 1855, 339; Mam. N. Am. 1857, 321; U. S. and Mex. Bound. Surv. ii, pt. ii, 1859, 39, pl. vii, fig. 3 (head and feet).

*Spermophilus mexicanus* AUDUBON & BACHMAN, Quad. N. Am. iii, 1853, 39 (in part).

*Spermophilus spilosoma* var. *spilosoma* ALLEN, Proc. Bost. Soc. Nat. Hist. xvi, 1874, 291.

**SPECIFIC CHAR.**—Length of head and body 6.50 to 7.00; of tail to end of vertebræ 2.50 to 3.00; to end of hairs 3.25 to 3.75. Above, reddish-brown, with indistinct subquadrate spots of white, bordered posteriorly with black. The spots are most distinct on the hinder part of the back, and are more distinct in the young than in the adult. Beneath, white, varying to strongly yellowish-white. Tail above colored like the back, with a single broad subterminal black bar, extending for only a short distance along the sides; beneath, centrally, brownish-yellow, with a black border edged with yellowish. The tail (vertebræ alone) is less than half the length of the body, round, generally bushy only at the tip, and not distinctly distichous. The

ears are very small, being little more than a thickened rim. Hairiness of the soles variable, the soles being in some specimens densely pilose, and in others nearly naked.

This species, in the general color of the dorsal surface, bears some resemblance to *S. mexicanus*, but it is of a lighter reddish, and lacks the distinct lines of white spots seen in the latter. It further differs in being smaller, in having a much broader and quite differently shaped skull, and in its very much shorter tail, which is slender and terete instead of somewhat full and distichous. Its nearest ally is *S. obsoletus*, from which it is but doubtfully distinct, differing mainly in its more reddish color and the greater distinctness of the white spots.

This species was first noticed by Mr. Bennett in 1833, who described it from two specimens supposed to have come from California, the locality being vaguely indicated as "that part of California which adjoins Mexico". The specimens were young, the molars being unworn, and the length only five inches and a quarter. Wagner, in 1843, thought it doubtfully distinct from *S. mexicanus*. Audubon and Bachman figured for it the young of *S. mexicanus*, and afterward, becoming aware of their mistake, completed the confusion of the two species by referring the *S. spilosoma* of Bennett to *S. mexicanus* as a synonym of that species! Its claim to distinct specific rank was again first asserted in 1855 by Professor Baird, who was able, from his abundant material, to fully make known its true characters and affinities. Although its distinctness has since, I think, been unquestioned, no additional specimens have been brought to light by recent collectors, so that I find now in the National Museum only the material used by Professor Baird, and have seen no other specimens. It is still apparently rare in collections.

Its known range extends from Fort Stanton, N. Mex. (Dr. T. C. Henry), and El Paso, Tex. (J. H. Clark), to Chihuahua (J. Potts) and Sonora (Dr. Kennerly), Mexico. Professor Baird\* states that "it occurs abundantly from the Gulf of California as far east as El Paso, and even northward to Fort Stanton". He further quotes from Dr. Kennerly's notes that it was "quite common around Janos", Sonora, "but exceedingly shy", so that "a specimen was procured with difficulty".

\*Rep. U. S. and Mex. Bound. Surv. vol. II, pt. II, p. 39.

TABLE CIX.—Measurements of three skulls of *SPERMOPHILUS SPILOSOMA*.

Catalogue-number.	Locality.	Sex.	Total length.	Greatest width.	Distance between orbits.	Nasal bones, length.	Nasal bones, width behind.	Upper incisors from front to molars.	Upper incisors from front to hinder margin of palate.	Upper incisors height.	Upper incisors, width between external edges.	Upper molars, length taken together.	Lower jaw, length.	Lower jaw, height.
1123	El Paso, Tex.....	♀	1.53	0.97	0.35	0.46	0.17	0.43	0.78	0.35	0.15	0.31	0.57	0.43
1134	.....do.....	.....	1.45	0.95	0.32	0.46	0.16	0.40	0.75	0.30	0.14	0.30	0.53	0.38
1651	Chihuahua, Mexico.....	.....	1.55	.....	0.32	0.50	.....	0.44	0.75	.....	.....	.....	0.55	0.43

TABLE CX.—Measurements of five specimens of *SPERMOPHILUS SPILOSOMA*.

Catalogue-number.	Locality.	Sex.	From tip of nose to tail.	Tail to end of—		Length of hind foot.	Nature of specimen.	Remarks.
				Vertebrae.	Hairs.			
990	Chihuahua City, Mexico.....	.....	6.50	.....	.....	1.10	Skin..	From Baird, Mam. N. Amer. p. 332.
1059	.....do.....	.....	7.00	2.20	3.00	1.25	.....do.....	
1043	Janos, Sonora, Mexico.....	.....	5.75	2.60	3.20	1.98	.....do.....	
141	El Paso.....	♀	6.30	3.00	3.75	1.25	.....do.....	
143	.....do.....	.....	5.50	2.50	3.00	1.25	.....do.....	

TABLE CXI.—List of specimens examined of *SPERMOPHILUS SPILOSOMA*.

Catalogue-number of skin.	Corresponding number of skull.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
1059	.....	.....	Chihuahua.....	.....	J. Potts.....	J. Potts.....	Skin.
990	1651	.....	.....do.....	.....	.....do.....	.....do.....	Skin and skull.
1043	9216	.....	Janos, Sonora.....	Apr. —, 1895	Maj. W. H. Emory..	Dr. C. D. B. Kennerly	.....do.
9619	.....	.....	Fort Stanton, N. Mex.....	—, 1895	.....do.....	Dr. T. C. Henry.....	Skin.
143	1134	.....	El Paso, Tex.....	—, 1899	.....do.....	J. H. Clark.....	Skin and skull.
141	1123	♀	.....do.....	—, 1898	.....do.....	.....do.....	.....do.

**SPERMOPHILUS OBSOLETUS Kennicott.****Kennicott's *Spermophile*.***Spermophilus obsoletus* KENNICOTT, Proc. Acad. Nat. Sci. Phila. 1863, 157.*Spermophilus spilosoma* var. *obsoletus* ALLEN, Proc. Bost. Soc. Nat. Hist. xvi, 1874, 201.

**SPECIFIC CHAR.**—Size and form of *S. spilosoma*. Length 5.80 to 6.50; tail to end of vertebrae 2.25 to 2.50; to end of hairs 3.00 to 3.50. Above, dull yellowish-brown, indistinctly spotted with lighter, especially posteriorly,

and in the younger specimens; beneath, strongly yellowish-white. The spots on the back are bordered posteriorly with black. The tail is terete toward the base, broader and tufted at the end; above, basally colored like the back, toward the end varied with black, and with a subterminal black border edged with yellowish-white. Ears nearly obsolete; soles either naked or hairy, according to the season; nails long, slender, and moderately curved.

This form is closely related to *S. spilosoma*, to which I formerly referred it as a variety, and I am still far from sure that such is not its true relationship. The two forms, in their extreme phases of differentiation, are quite widely different in coloration, but in the younger stages they are almost inseparable. The skull of *S. obsoletus* is rather narrower in proportion to its length than that of *S. spilosoma*, and the nasals are longer. In size, proportions, form of the tail, and markings, the two are identical, but the tone of the coloration is quite different. In *S. spilosoma*, the general color above is light reddish-brown or cinnamon; in *S. obsoletus*, pale yellowish-brown. Some of the younger specimens of *obsoletus*, as No. 3223, from the Laramie Plains, show a decided cast of reddish, and are scarcely distinguishable from examples of *spilosoma* from Texas. Its recognition as specifically distinct from *S. spilosoma* is merely provisional and made with much doubt.

*S. obsoletus* was first described by Mr. Kennicott, in 1863, from specimens collected in Southern Wyoming, Dakota, and Utah, in 1857 and 1858. The subjoined list of specimens shows it to range from the Black Hills and Fort Kearney westward to Utah. Nothing further is known respecting its distribution, and none of the recent expeditions to this region have apparently met with it. It is to be hoped that future explorers will be able to add to our knowledge of its history.

TABLE CXII.—Measurements of three skulls of SPERMOPHILUS OBSOLETUS.

Catalogue number.	Locality.	Sex.	Total length.	Greatest width.	Distance between orbits.	Nasal bones, length.	Nasal bones, width behind.	Upper incisors from front to molars.	Upper incisors from front to hinder margin of palate.	Upper molars, length taken together.	Lower jaw, length.	Lower jaw, height.
4795	Black Hills .....	.....	1.51	0.92	0.39	0.53	0.15	0.45	0.80	0.31	0.85	0.42
4813	Fort Laramie .....	♂	1.55	0.92	0.35	0.58	0.15	.....	.....	.....	0.86	0.38
4911	330 miles west of Fort Kearney .....	.....	.....	0.92	0.31	0.53	.....	0.45	0.75	0.58	0.86	0.40



TABLE CXIII.—Measurements of three specimens of *SPERMOPHILUS OBSOLETUS*.

Catalogue-number.	Original number.	Locality.	Sex.	From tip of nose to—		Tail to end of—		Nature of specimen.
				Occiput.	Tail.	Vertebra.	Hairs.	
3224	49	50 miles west of Fort Kearney.....	♀	1.35	5.85	2.40	3.45	Fresh.
3228	44	230 miles west of Fort Kearney.....	♀	1.70	5.80	2.25	2.80	... do.
3144	66	Fort Laramie.....	♂	1.60	5.30	2.35	3.30	... do.

TABLE CXIV.—List of specimens examined of *SPERMOPHILUS OBSOLETUS*.

Catalogue-number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Specimen.
3222	4795	...	...	Black Hills, Dak. ....	...	Gen. G. K. Warren.	Dr. F. V. Hayden..	Skin and skull.
3222	4795	...	44 ♀	50 miles west of Ft. Kearney	Aug. 8, 1857	W. M. F. Magraw.	Dr. J. G. Cooper...	Skin.
3224	4611	40 ♀	...	230 miles west of Ft. Kearney	Aug. 17, 1857	...do.	...do.	Skin and skull.
3225	46	♂	...	do.	Aug. 17, 1857	...do.	...do.	Skin.
3223	45	♂	...	do.	Aug. 17, 1857	...do.	...do.	do.
3140	66	...	...	Fort Laramie.....	Sept. 22, 1857	...do.	...do.	do.
3144	4813	66	♂	do.	Sept. 30, 1857	...do.	...do.	Skin and skull.
3228	...	...	...	do.	Sept. 8, 1857	...do.	C. Drexler.....	Skull.
3776	50	...	...	O'Fallon's Bluff, Utah.....	July 17, 1859	Capt. J. H. Simpson	C. S. McCarthy....	do.

## SPERMOPHILUS MEXICANUS (Licht.) Wagner.

## Mexican Spermophile.

? *Sciurus mexicanus* ERZLEBEN, Syst. Anim. 1777, 428 (in part only, if at all. From FERNANDEZ and SEBA, etc. Also *Sciurus mexicanus* of SCHREBER, GMELIN, SHAW, FISCHER, and other early compilers, based on the same).

*Citellus mexicanus* LICHTENSTEIN, Darst. Säuget. 1827-34 (not paged), pl. xxxi, fig. 2.

*Spermophilus mexicanus* WAGNER, Suppl. Schreber's Säuget. iii, 1843, 250.—BRANDT, Bull. Physico-math. Classe Acad. St. Pétersb. ii, 1844, 380.—SCHINZ, Syn. Mamm. ii, 1845, 66.—AUDUBON & BACHMAN, Quad. N. Amer. iii, 1853, 39, pl. cix (exclusive of supposed young).—GIEBEL, Säuget. 1855, 638.—BAIRD, Mam. N. Amer. 1857, 319; U. S. and Mex. Bound. Surv. ii, pt. ii, 1859, 39.—ALLEN, Proc. Bost. Soc. Nat. Hist. xvi, 1874, 291.

*Sciurus tamsuipensis* BERLANDIER, M88.

? *Tlaxmotitli*, FERNANDEZ, Anim. 1651, 9.

? *Sciurus variscinus*, ex Novæ Hispaniæ, *taxis albis*, SEBA, Thes. i, 1734, 76, pl. xlvi, fig. 2.

**SPECIFIC CHARS.**—Length of head and body 8.00 to 8.50; of tail to end of vertebrae 4.00 to 4.50; to end of hairs about 5.75. Above, rather dark yellowish-brown, varying to reddish-brown, with generally a decided tinge of olivaceous and numerous rather distinct lines (generally either nine or eleven) of subquadrate spots of white; below, whitish, varying to yellowish-white on

the sides; ring surrounding the eye and lower edge of cheeks white; head above finely mixed white, black, and yellowish; tail above varied centrally with black and yellowish-white, with an indistinct black border broadly edged with yellowish-white; below, brownish-white centrally, with a distinct sub-terminal band of black and a broad edging of brownish-white. The hairs individually have a narrow black bar at the base, followed by alternate bars of brownish-white and black, three of each, the terminal one being whitish.

This species varies as usual more or less in respect to general color, that of the dorsal surface ranging from dull ashy-brown to chestnut. The number of rows of white spots varies from nine to thirteen, but either nine or eleven is the more common number, the two or three central ones on either side of the median line being generally much more distinct than the outer ones. In the latter, the white spots are longer and nearer together, forming sometimes an almost uninterrupted line. The ears are very small, but distinct. The tail-vertebræ alone are rather more than half the length of the head and body; claws long, that of the thumb quite large. Soles nearly naked. Pelage coarse and stiff, the hairs mostly grooved above.

In size and proportions, as well as in the pattern of coloration, this species more resembles *S. tridecemlineatus* than any other, but differs from it quite markedly in many details. The tail is longer and more bushy, with three narrow longitudinal lines of black beneath instead of one very broad one (in addition, there is, however, in *S. tridecemlineatus*, a narrow basal one); the general color above is much lighter and of a quite different shade, with interrupted lines of whitish spots instead of six or more narrow, continuous, yellowish-white stripes, with a similar number of interrupted ones between them; there are also well-marked differences in the skull. In respect to cranial characters, however, *S. mexicanus* finds also its nearest ally in *S. tridecemlineatus*.

In respect to coloration, there is considerable resemblance between *S. mexicanus* and *S. spilosoma*; but, in other features, the two species differ widely, as already noticed in the account of *S. spilosoma*.

This species was first recognizably described and figured by Lichtenstein, about 1830, from a specimen collected by Herr F. Deppe, in July, 1826, in the neighborhood of Toluca, Mexico. Erxleben, in 1777, characterized a "*Sciurus mexicanus*"; based on Fernandez's description of his "*Tlamototli*";

and on Seba's "*Sciurus, rarissimus, ex Novâ Hispaniâ, tæniis albis*,"\* together with references to Brisson, Pennant, and other early authors, whose accounts are based wholly on Fernandez and Seba. Erxleben's *Sciurus mexicanus* has, by several writers, been considered as identical with the *Citillus mexicanus* of Lichtenstein; but Fischer, as early as 1829, and hence before Lichtenstein described his *Citillus mexicanus*, suggested that Erxleben's *Sciurus mexicanus* might be referable to the *Sciurus (Tamias) striatus* of authors. While Fernandez's "*Tlamoctli*", and also Seba's animal, judging by both his figure and description (disregarding altogether its impossible tail), may be referable to *Spermophilus mexicanus*, the introduction of this species into the annals of natural history cannot with certainty be carried back beyond Lichtenstein's detailed description and excellent figure. It has since been well figured by Audubon and Bachman, while Baird's further account of it leaves little now to be added, especially since no specimens additional to those used by Professor Baird are at present accessible. The only synonym that appears to have thus far arisen is the *spilosoma* of Audubon and Bachman, who erroneously referred the young of *S. mexicanus* to that species, and finally thoroughly confounded the two species.

It is chiefly a Mexican animal, but is quite abundant on the Texan side of the Rio Grande; it has not, however, been reported from further northward. Nearly all the specimens in the collection of the National Museum are from the vicinity of the Rio Grande. It probably ranges far southward over the plains of Eastern Mexico, Audubon and Bachman stating that they had been informed of its occurrence as far southward as the province of Vera Cruz.

TABLE CXV.—Measurements of two skulls of *SPERMOPHILUS MEXICANUS*.

Catalogue number.	Original number.	Locality.	Total length.	Greatest width.	Distance between orbits.	Nasal bones, length.	Nasal bones, width behind.	Nasal bones, width before.	Upper incisors from front to molars.	Upper incisors from front to hinder margin of palate.	Upper incisors, height.	Upper incisors, with between external edges.	Upper molars, length taken together.	Lower jaw, length.	Lower jaw, height.
1441	.....	Laredo, Tex. ....	1.75	1.00	0.35	0.55	0.18	0.30	0.55	0.95	0.91	0.17	0.55	1.00	0.46
1650	803	Pesquera Grande, Mexico	1.65	0.93	0.35	0.57	0.17	0.30	0.50	0.87	0.95	0.15	0.50	0.90	0.46

\* Thesaurus, vol. i, p. 76, pl. xlvii, fig. 2, 1734.

TABLE CXVI.—Measurements of eight specimens of SPERMOPHILUS MEXICANUS.

Catalogue-number.	Locality.	Sex.	From tip of nose to—				Tail to end of—		Length of—		Height of ear.	Nature of specimen.
			Eye.	Ear.	Occiput.	Tail.	Vertebra.	Hairs.	Pure foot.	Heel foot.		
9498	Matamorras, Mexico.....	♂	0.80	1.80	1.85	8.00	4.00	5.90	1.00	1.00	0.93	Alcoholic.
9499	.....do.....	♂	0.85	1.60	1.85	7.25	.....	.....	0.95	1.55	0.95	.....do.
9500	.....do.....	♀	0.85	1.50	1.90	7.15	.....	.....	0.90	1.55	0.90	.....do.
153	Eagle Pass, Tex.....	.....	.....	.....	.....	8.50	4.25	5.90	.....	1.50	.....	Skin.
138	.....do.....	.....	.....	.....	.....	8.25	4.25	.....	.....	1.25	.....	.....do.
358	Brownsville, Tex.....	.....	.....	.....	.....	8.50	4.50	5.75	.....	1.25	.....	.....do.
1719	Western Texas.....	.....	.....	.....	.....	8.50	.....	.....	.....	1.50	.....	.....do.
9804	Fort Bliss, N. Mex.....	♀	0.70	1.50	1.80	7.00	4.50	5.95	1.10	1.65	0.17	Alcoholic.

TABLE CXVII.—List of specimens examined of SPERMOPHILUS MEXICANUS.

Catalogue-number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
1719	.....	.....	.....	Western Texas.....	.....	Capt. J. Pope.....	Capt. J. Pope.....	Skin.
1137	155	.....	.....	Eagle Pass, Tex.....	.....	A. Schott.....	.....	.....do.
3089	.....	.....	.....	.....do.....	.....	Maj. W. H. Emory.....	Dr. C. R. R. Kennerly.....	.....do.
1967	359	.....	.....	Brownsville, Tex.....	Feb. —, 1853	Lieut. D. N. Couch.....	.....	.....do.
1746	81	.....	.....	Pecos River, Tex.....	May 14, 1855	.....do.....	.....do.....	.....do.
516	1658	96J	.....	Poquierra Grande, Mx.	May —, 1853	.....do.....	.....do.....	Skin and skull.
8987	.....	.....	.....	Matamorras, Mexico.....	.....do.....	.....do.....	L. Berlandier.....	Skin.
1494	.....	.....	.....	.....do.....	.....do.....	.....do.....	.....do.....	Skull.
1441	.....	.....	.....	.....do.....	.....do.....	.....do.....	.....do.....	.....do.
8580	118	♂	.....	Laredo, Tex.....	May 11, 1866	.....do.....	.....do.....	Skin.
8581	130	♂	.....	.....do.....	May 14, 1866	.....do.....	.....do.....	.....do.
8589	75	.....	.....	.....do.....	May 3, 1866	.....do.....	.....do.....	.....do.
8615	276	♀	.....	.....do.....	June 30, 1866	.....do.....	.....do.....	.....do.
9816	409	.....	.....	.....do.....	Aug. —, 1866	.....do.....	.....do.....	.....do.

SPERMOPHILUS TRIDECIMLINEATUS (Mitchill) Aud. & Bach.

Striped Spermophile.

Var. TRIDECIMLINEATUS.

Eastern Striped Spermophile.

*Sciurus tridecimlineatus* MITCHILL, Mod. Repos. xxi, 1891, 948.—DESMAREST, Mamm. ii, 1822, 330 (from Mitchill).

*Arctomys tridecimlineatus* HARRIS, Faun. Amer. 1895, 164.—GODMAN, Am. Nat. Hist. ii, 1896, 112.

*Spermophilus tridecimlineatus* AUDUBON & BACHMAN, Quad. N. Amer. i, 1849, 294, pl. xxxix.—HOY, Pat. Off. Rep. Agr. 1853 (1854), 68 (habita).—KENNICOTT, ib. 1856 (1857), 74, pl. viii (general history).—BAIRD, Mamm. N. Amer. 1857, 316 (in part).—THOMAS, Trans. Ill. State Agr. Soc. iv, 1860, 687.—ALLEN, Proc. Bost. Soc. Nat. Hist. xiii, 1870, 169 (Iowa).

*Spermophilus tridecimlineatus* var. *tridecimlineatus* ALLEN, Proc. Bost. Soc. Nat. Hist. xvi, 1874, 291.

- Arctomys hoodi* SABINE, Trans. Linn. Soc. xlii, 1822, 590, pl. xxix; Franklin's Journal, 1893, 663 (Carlton House).—FISCHER, Synop. Mamm. 1829, 544 (from Sabine).—WAGNER, Schreber's Säugth. pl. cccx (name on plate).
- Arctomys (Spermophilus) hoodi* RICHARDSON, Faun. Bor.-Amer. i, 1829, 177, pl. xiv.
- Spermophilus hoodi* "F. CUVIER, Suppl. Buffon, i, Mamm. 1831, 337".—MAXIMILIAN, Reise in d. innere Nord-Amer. i, 1830, 449; Arch. f. Naturgesch. 1861, 84.—WAGNER, Suppl. Schreber's Säugth. iii, 1843, 251.—BRANDT, Bull. Physico-math. Classe Acad. St. Pétersb. ii, 1844, 379.—SCHINZ, Syn. Mamm. ii, 1845, 60.—GIEBEL, Säugth. 1855, 636.
- Federation Squirrel*, MITCHELL, l. c.
- Leopard Ground Squirrel*, SCHOOLCRAFT, Travels, 1821, 331 (name in index).
- Ecureuil de la Fédération*, DESMAREST, l. c.
- Striped American Marmot*, SABINE, l. c.
- Striped and Spotted Ground Squirrel*, SAY, Long's Exped. ii, 1823, 174.—KENNICOTT, l. c.
- Spermophile rayé*, F. CUVIER, Hist. des Mamm. livr. xvi, 1824.
- Hood's Marmot*, GODMAN, l. c.
- Leopard Marmot*, RICHARDSON, l. c.
- Der Leoparden-Ziesel*, WAGNER, l. c.
- Leopard-Spermophile*, AUDUBON & BACHMAN, l. c.
- Striped Gopher, or Prairie Ground Squirrel*, HOY, l. c.
- Striped Prairie Squirrel*, BAIRD, l. c.

#### Var. PALLIDUS.

##### Pale Striped Spermophile.

- Spermophilus tridecemlineatus* WOODHOUSE, Sitgreave's Zuni and Colorado River Exped. 1853, 52 (Ind. Terr.).—BAIRD, Mamm. N. Amer. 1857, 316 (in part).—SUCKLEY, Nat. Hist. Wash. Terr. pt. iii, 1860, 98 (in part).—HAYDEN, Trans. Amer. Phil. Soc. Phila. xii, 1863, 147.—ALLEN, Bull. Essex Inst. vi, 1874, 40, 57.—COUES & YARROW, Wheeler's Expl. West of 100th Merid. v, Zool. 1875, 130.—GRINNELL, Ludlow's Black Hills of Dakota, 1875, 82.
- Spermophilus tridecemlineatus* var. *pallidus* ALLEN, Proc. Bost. Soc. Nat. Hist. xvi, 1874, 291.

**SPECIFIC CHARs.**—Length to base of tail 5.50 to 8.50; of tail-vertebræ 2.75 to 4.00; of tail to end of hairs 3.75 to 5.50. Above dark chestnut-brown, varying with locality from pale chestnut-brown through reddish-chestnut to nearly black, with seven nearly uninterrupted lines of yellowish-white, extending from the forehead to the tail, and alternating with six longitudinal rows of subquadrate yellowish-white spots; below yellowish-white, varying to tawny, strongest on the sides; buttocks more ferruginous; eye-ring yellowish-white; upper surface of muzzle gray, sides and front yellowish; tail narrow, black both above and below, varied somewhat with chestnut, and whitish-edged. The hairs are reddish-yellow basally, crossed by a broad band of black, and light-tipped. General form slender and Musteline; ears very small, in the dried skin the auricle being little more than a slightly projecting rim; tail, with the hairs, generally rather more than half the length of the head and body.

#### Var. TRIDECIMLINEATUS.

**VARIETAL CHARs.**—Length to base of tail 7.25 to 8.50; of tail-vertebræ 3.40 to 4.00; of tail to end of hairs 3.40 to 4.75. Above deep chestnut-

brown, varying to nearly black; the white lines rather narrow, about one-third the width of the interspaces; sides strongly yellowish, varying to yellowish-rufous.

The specimens referred to var. *tridecemlineatus* are from the prairie region of the Mississippi Valley and northward, and differ from those referred to var. *pallidus* in being much larger and darker. The dark portion of the dorsal surface is decidedly blackish, mixed generally more or less with very dark chestnut, but sometimes is clear, quite intense black, as in No. 11545, from Turtle Mountain, 49th parallel, and others from Pembina, Dak., Racine, Wis., and Northern Illinois. Others, however, from the same localities, show considerably more chestnut, some being clear dark chestnut, with very little black. The color of the lower surface also varies from pale yellowish-white to pale rufous. In No. 986, from Racine, the sides of the neck, shoulders, and the breast are strongly yellowish-rufous, and the buttocks brownish-rufous. There are generally three and sometimes four narrow but distinct and continuous yellowish-white stripes on each side of the median line, alternating with five broad dark ones, which are from three to four times the width of the light stripes. The middle of each dark space is traversed by an interrupted line of squarish, sharply-defined, yellowish-white spots, usually separated from each other by a dark interval about equalling their own length. Along the median line, especially anteriorly, they frequently tend to form a continuous narrow light line. Lower down on the sides of the body are one to two other shorter light stripes, more suffused with yellow, and separated by a dark space of about their own width, generally without light spots. Anteriorly, over the shoulders, the light spots in the dark spaces tend to become confluent, forming nearly unbroken light lines, alternating with dark ones of about the same width. In such cases, the second light line from the middle of the back, on either side, disappears at the shoulder, where the interrupted line ceases to be a continuous stripe. Hence, over the shoulders the *pictura* is resolved into seven continuous light stripes separated by broader dark ones. In about one specimen in thirty, the markings are irregular and the lines all broken and somewhat indistinct.

Var. PALLIDUS.

VARIETAL CHARs.—Length to base of tail 5.75 to 6.75; of tail-vertebræ 2.75 to 3.50; of tail to end of hairs 3.50 to 4.25. Smaller; above paler,

with the light stripes whiter, and wider, nearly equalling the interspaces; also much paler on the sides and whiter below.

Specimens from different localities vary somewhat in color, the variations being similar to those in var. *tridecemlineatus*, but less marked. The light stripes are generally grayish-white, sometimes suffused a little with yellowish, and the dark interspaces are generally pale chestnut, varying to more dusky. The light stripes are generally more than half the width of the dark interspaces, and sometimes equal them. Among the palest and smallest examples are the specimens from Fort Union and the Yellowstone and Platte Rivers, an especially pale and small phase characterizing the Mauvaises Terres of the Upper Missouri region.

GENERAL REMARKS UPON *Spermophilus tridecemlineatus* AND ITS VARIETIES.

**DIFFERENTIAL CHARACTERS AND AFFINITIES.**—In pattern of coloration, *Spermophilus tridecemlineatus* quite strongly resembles *S. mexicanus*, but differs from it in having the ground-color of the dorsal surface much darker, and in the possession of continuous light stripes, alternating with interrupted lines of detached light spots, *S. mexicanus* having merely longitudinal rows of disconnected white spots, which cease at the occiput, instead of continuing over the top of the head to the forehead. *S. mexicanus* is also smaller, and has a longer tail, and differs in the characters of the skull, as already shown.

In general form, and especially in the form of the skull, *S. tridecemlineatus* resembles *S. franklini*, but it is much smaller, with a much narrower tail and entirely different pattern of coloration. It hence has no very near American ally, and is still more distinct from any of the Old World *Spermophiles*.

The two varieties of *S. tridecemlineatus*, in their extreme phases, quite widely differ in respect to size and color, but agree in every detail of form, proportion, and pattern of coloration; var. *pallidus* being merely a bleached, depauperate, desert form of *tridecemlineatus*. In var. *pallidus*, the tints are not only paler, but the light spots and stripes increase in breadth at the expense of the darker ground-color. Var. *pallidus* reaches its extreme phase of differentiation in the driest portions of the plains and the desert regions more to the westward; var. *tridecemlineatus* is most specialized over the fertile prairies of the Mississippi Valley and thence northward along the Red River and the region to the westward of Lake Winnipeg. Specimens from



the eastern edge of the plains are intermediate in color and size between the two varieties; those from Eastern Kansas and Eastern Nebraska, from as far west as Topeka and Fort Riley, are still referable to the eastern rather than the western race, but those from Western Nebraska, Western Kansas, and Colorado are distinctly referable to var. *pallidus*. In Fort Riley and Topeka specimens, the dark ground-color is more rufous, especially on the sides, and the light markings are of a clearer grayish-white.

**SYNONYMY AND NOMENCLATURE.**—The present species was first described by Dr. Mitchill in June, 1821, as *Sciurus tridecemlineatus*, from specimens collected during the summer of 1820, on the Upper Mississippi, by Professor Douglass of the United States Military Academy. It was redescribed by Sabine,\* about eight months later, under the name of *Arctomys hoodi*, from specimens collected near Carlton House in May, 1820. While *tridecemlineatus* has been almost universally adopted by American writers as the name of this species of *Spermophile*, Sabine's later name of *hoodi* has been as uniformly adopted by English and European writers. The species has thus far escaped other synonyms. It has, however, been burdened with a great number of vernacular names, scarcely two authors having adopted the same vernacular appellation. In 1874, I briefly characterized the pale desert race as var. *pallidus*.

Nuttall was probably the first naturalist who observed this animal, who, some years prior to its discovery at other localities, met with it at the Mandan village on the Upper Missouri, and, according to Say,† sent specimens of it to "several of his scientific friends in London" as early as 1814. It appears, however, to have been first described, as above stated, by Dr. Mitchill in 1821. Dr. Hoy and Mr. Kennicott have made interesting contributions to its biography, the former noting especially its carnivorous, Weasel-like propensities.

**GEOGRAPHICAL DISTRIBUTION.**—The most northerly point at which this species has been observed seems to be the vicinity of Carlton House on the Saskatchewan, where Richardson states he found it quite common. It is abundant at the Red River Settlements and in the neighborhood of Pembina, and is doubtless common at all favorable localities between these points and the Saskatchewan River. In the United States, it has been met with at fre-

\* Dr. Sabine's paper was read before the Royal Society of London "Jan. 15, 1822", and was not published till some months later. Dr. Mitchill's description appeared in June, 1821.

† Long's Expedition to the Rocky Mountains, vol. II, p. 174 (apparently quoted by Harlan without credit to the original authority).



quent intervals from Minnesota westward to the Rocky Mountains and southward to Missouri and Western Texas. As shown by the subjoined lists of specimens, it has been taken at Eagle Pass (Texas), Fort Garland (Southern Colorado), Southwestern Wyoming, and Fort Bridger, Utah. Woodhouse also met with it on the prairies of the Cherokee Nation. It is abundant throughout the prairie region east of the Mississippi, from Minnesota and Wisconsin eastward to Northern Ohio. Kennicott states that its range in Illinois does not extend southward beyond latitude 39°.

TABLE CXVIII.—Measurements of six skulls of *SP. TRIDECERLINEATUS* var. *TRIDECERLINEATUS*.

Catalogue-number.	Locality.	Sex.	Total length.	Greatest width.	Distance between orbits.	Nasal bones, length.	Nasal bones, width behind.	Nasal bones, width before.	Upper incisors from front to molars.	Upper incisors from front to hinder margin of palate.	Upper incisors, height.	Upper incisors, width between external edges.	Upper molars, length taken together.	Lower jaw, length.	Lower jaw, height.
1364	Racine, Wis.....	♂	1.57	0.90	0.30	0.50	0.19	0.30	0.46	0.70	0.25	0.17	0.30	0.98	0.37
13377	Pembina, D. T.....	♂	1.75	1.00	0.35	0.60	.....	.....	0.53	0.78	.....	.....	0.30	1.00	0.37
13278	.....do.....	♂	1.60	0.98	0.33	0.60	0.19	.....	0.46	.....	.....	.....	0.30	0.90	.....
13375	.....do.....	♂	1.67	0.90	0.55	.....	.....	.....	0.58	0.87	.....	.....	0.31	0.91	0.42
13376	.....do.....	♂	1.72	1.10	0.35	0.56	0.30	.....	0.52	0.90	.....	.....	0.30	1.00	0.43
13379	.....do.....	♂	1.63	1.12	0.37	0.60	0.23	0.28	0.60	0.94	0.25	0.19	0.30	1.08	0.45

TABLE CXIX.—Measurements of two skulls of *SPERMOPHILUS TRIDECERLINEATUS* var. *PALLIDUS*.

Catalogue-number.	Locality.	Total length.	Greatest width.	Distance between orbits.	Nasal bones, length.	Nasal bones, width behind.	Nasal bones, width before.	Upper incisors from front to molars.	Upper incisors from front to hinder margin of palate.	Upper incisors, height.	Upper incisors, width between external edges.	Upper molars, length taken together.	Lower jaw, length.	Lower jaw, height.
3310	West of Laramie, Wyo. Ter.....	1.43	0.85	0.28	0.58	0.12	0.04	0.45	0.70	0.28	0.10	0.28	.....	.....
6591	Snatch Creek.....	1.66	1.08	0.35	0.60	0.20	0.20	0.50	0.80	0.28	0.10	0.30	0.95	0.45

TABLE CXX.—Measurements of twelve specimens of *SP. TRIDECIMLINEATUS* var. *TRIDECIMLINEATUS*.

Catalogue-number.	Original number.	Locality.	Sex.	From tip of nose to—				Tail to end of—		Length of—		Nature of specimen.	Remarks.
				Eyes.	Ears.	Occiput.	Tail.	Vertebrae.	Hairs.	Fore foot.	Hind foot.		
1038		Pembina, D. T.	♂	0.78	1.35	1.90	7.50	.....	.....	0.85	1.55	Alcoholic.	From Baird, Man. N. Am. p. 318.
8518		Lansing, Mich.		0.78	1.40	1.89	6.00	.....	.....	0.75	1.30		
10		Racine, Wis.		.....	.....	.....	7.10	3.14	3.80	.....	1.91	Skin	do.
11		do.		.....	.....	.....	7.28	3.68	3.23	.....	1.40	do.	do.
105		do.		.....	.....	.....	6.30	.....	.....	0.65	1.50	do.	do.
103		do.		.....	.....	.....	7.98	3.90	4.50	0.90	1.60	do.	do.
988		do.		0.74	1.38	1.90	6.70	.....	.....	.....	1.35	do.	do.
8291		do.		0.70	1.40	1.68	.....	3.40	4.10	0.90	1.38	do.	do.
11565		Pembina, D. T.	♂	0.85	1.70	2.00	8.50	3.90	5.00	.....	.....	Fresh	.....
11548		do.		0.75	1.50	1.99	8.00	3.50	4.50	0.90	1.50	do.	do.
11578		do.		0.75	1.60	1.85	8.00	4.00	4.70	.....	.....	do.	do.
1038		do.	♂	0.78	1.55	1.90	7.50	.....	.....	0.85	1.55	do.	do.

TABLE CXXI.—Measurements of sixteen specimens of *SPERMOPHILUS TRIDECIMLINEATUS* var. *PALLIDUS*.

Catalogue-number.	Original number.	Locality.	Sex.	From tip of nose to—				Tail to end of—		Length of—		Height of ear.	Nature of specimen.
				Eye.	Ear.	Occiput.	Tail.	Vertebra.	Hair.	Fore foot.	Hind foot.		
549	.....	Cheyenne, Wyo. Ter.	.....	0.75	1.40	1.58	5.85	2.50	3.80	0.68	1.39	.....	Fresh.
550	.....	do.	.....	0.77	1.40	1.58	5.90	2.70	3.52	0.69	1.52	.....	do.
1210	.....	do.	♂	0.85	1.40	1.60	6.10	2.40	3.65	0.70	1.97	.....	do.
747	.....	South Park, Colo.	♂	0.80	1.35	1.70	6.00	2.85	3.00	0.60	1.85	.....	do.
748	.....	do.	♂	0.85	1.39	1.65	6.00	2.89	3.00	0.65	1.93	.....	do.
989	.....	do.	.....	0.84	1.23	1.50	5.00	3.00	4.00	0.95	1.38	.....	do.
986	.....	do.	♂	.....	.....	.....	6.25	3.25	4.25	0.90	1.30	.....	do.
997	.....	do.	♂	0.84	1.35	1.63	6.20	2.89	3.09	0.64	1.30	.....	do.
998	.....	do.	♂	0.85	1.40	1.56	5.75	3.05	3.00	0.87	1.30	.....	do.
8519	.....	Red River, Ark.	♂	0.80	1.45	1.78	5.90	3.40	4.08	0.78	1.30	.....	Alcoholic.
1771	.....	Upper Missouri.	.....	.....	.....	.....	6.50	3.50	4.25	.....	.....	.....	do.
8303	.....	do.	♂	0.78	1.44	1.70	6.75	.....	.....	0.89	1.40	0.90	do.
8517	.....	do.	.....	0.70	1.35	1.60	5.50	3.10	3.55	0.88	1.25	0.18	do.
4898	.....	Fort Laramie.	.....	0.65	1.23	1.55	5.50	2.75	3.25	0.75	1.00	0.15	do.
19	.....	Denver, Colo.	♀	0.75	1.43	1.65	6.75	3.50	4.40	0.82	1.35	0.17	do.
100	.....	South Park, Colo.	♀	0.63	1.30	1.60	5.90	2.95	3.70	0.88	1.17	.....	do.

TABLE CXXII.—List of specimens examined of *SPERMOPHILUS TRIDORMLINEATUS* *var. TRIDORMLINEATUS*.

Catalogue-number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
3258				Red River Settlement.		D. Gunn.	D. Gunn.	Skin.
11567	2871		♀	Pembina, Dak. Ter.	June 5, 1873	A. Campbell.	Dr. E. Cones.	do.
11569	2883		♂	do.	June 6, 1873	do.	do.	do.
11553	2946		♀	do.	June 4, 1873	do.	do.	do.
11554	3040		♀	do.	June 6, 1873	do.	do.	do.
11548	3074		♀	do.	June 20, 1873	do.	do.	do.
11671	3087		♀	do.	June 22, 1873	do.	do.	do.
11592	3089		♀	do.	June 22, 1873	do.	do.	do.
11551	3090		♀	do.	June 22, 1873	do.	do.	do.
11574	3091		♀	do.	June 22, 1873	do.	do.	do.
11566	3092		♀	do.	June 22, 1873	do.	do.	do.
11550	3098		♀	do.	June 22, 1873	do.	do.	do.
11584	3139		♀	do.	June 24, 1873	do.	do.	do.
11573			♀	do.	June 24, 1873	do.	do.	do.
11570	3140		♀	do.	June 24, 1873	do.	do.	do.
11555	3143		♀	do.	June 24, 1873	do.	do.	do.
11575	3145		♀	do.	June 24, 1873	do.	do.	do.
11580	3141		♀	do.	June 24, 1873	do.	do.	do.
11581	3148		♀	do.	June 24, 1873	do.	do.	do.
11560	3146		♀	do.	June 24, 1873	do.	do.	do.
11570	3147		♀	do.	June 24, 1873	do.	do.	do.
11547	3193		♀	do.	June 22, 1873	do.	do.	do.
11558	3194		♀	do.	June 22, 1873	do.	do.	do.
11549	3195		♀	do.	June 22, 1873	do.	do.	do.
11569	3196		♀	do.	June 22, 1873	do.	do.	do.
11563	3127		♀	do.	June 22, 1873	do.	do.	do.
11569	13075	3199	♀	do.	June 22, 1873	do.	do.	Skin and skull.
11565	13076	3200	♀	do.	June 22, 1873	do.	do.	do.
11568	13077	3203	♀	do.	June 22, 1873	do.	do.	do.
11573	13078		♀	do.	June 22, 1873	do.	do.	do.
11530	12879	3204	♀	do.	June 22, 1873	do.	do.	do.
11557		3205	♀	do.	June 22, 1873	do.	do.	Skin.
11574		3206	♀	do.	June 22, 1873	do.	do.	do.
11556		3204	♀	do.	June 24, 1873	do.	do.	do.
11576		3207	♀	do.	June 22, 1873	do.	do.	do.
11561		3208	♀	do.	June 22, 1873	do.	do.	do.
11578	3414		♂	Turtle Mt., Dak. Ter.	Aug. 9, 1873	do.	do.	do.
11546	3567		♂	Souris River, Dak. Ter.	Aug. 24, 1873	do.	do.	do.
11545	3556		♂	Turtle Mt., Dak. Ter.	July 23, 1873	do.	do.	do.
11577	3748		♀	La Rivière Lac, Dak. Ter.	Sept. 13, 1873	do.	do.	do.
11582	3830		♀	Pembina, Dak. Ter.	June 30, 1873	do.	do.	do.
11604				do.	June 30, 1873	do.	do.	do.
9719				Princeton, Minn.	May 5, 1857	O. E. Garrison.	O. E. Garrison.	do.
3003				do.	May 5, 1857	do.	do.	do.
900				Minewokas Lake, Minn.	July 12, 1853	Gov. I. I. Stevens.	Dr. Geo. Buckley.	do.
901				do.	July 12, 1853	do.	do.	do.
*1079				Minneapolis, Minn.	June 11, 1861	Horace Mann, Jr.	Horace Mann, Jr.	Alcoholic.
*1080				do.	May 20, 1861	do.	do.	do.
*945				do.	do.	do.	do.	do.
*1081				do.	do.	do.	do.	do.
*3760	11			do.	do.	do.	do.	do.
*3763	10			do.	do.	do.	do.	do.
*3764	33			do.	do.	do.	do.	do.

\* In Museum of Comparative Zoology, Cambridge, Mass.

TABLE CXXII.—List of specimens examined of *Sp. TRIDECIMLINEATUS* var. *TRIDECIMLINEATUS*—Continued.

Catalogue number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
*3765	.....	7	.....	Minneapolis, Minn.....	.....	Horace Mann, jr ..	Horace Mann, jr ..	Alcoholic.
*3766	.....	13	.....	do .....	.....	do .....	do .....	do.
*700	.....	.....	.....	Burlington, Iowa .....	.....	Dr. Rauch .....	Dr. Rauch .....	do.
*761	.....	.....	.....	do .....	.....	do .....	do .....	do.
*2421	.....	1463	.....	Evanston, Ill.....	.....	Prof. O. Marcy ..	Prof. O. Marcy ..	do.
*2422	.....	1473	.....	do .....	.....	do .....	do .....	do.
*910	.....	.....	.....	Lawa Ridge, Ill.....	.....	Hendrick Butler ..	Hendrick Butler ..	do.
*1935	.....	.....	.....	do .....	.....	do .....	do .....	do.
*1603	.....	303	.....	Ogle County, Ill.....	June —, 1897	J. A. Allen .....	J. A. Allen .....	Skin.
*1603	.....	364	.....	do .....	June —, 1897	do .....	do .....	do.
*1604	.....	305	.....	Greene County, Iowa ..	Aug. —, 1897	do .....	do .....	do.
*1605	.....	306	.....	Dallas County, Iowa ..	Aug. —, 1897	do .....	do .....	do.
*1606	.....	.....	.....	do .....	Aug. —, 1897	do .....	do .....	do.
*2654	.....	275	.....	Topeka, Kans.....	May 18, 1871	Rocky Mountain Expedition.	J. A. Allen and C. W. Bennett.	do.
10	.....	.....	.....	Racine, Wis.....	.....	Dr. P. R. Hoy.....	Dr. P. R. Hoy.....	do.
340	1994	.....	.....	do .....	.....	do .....	do .....	do.
11	.....	.....	.....	do .....	.....	do .....	do .....	do.
105	.....	○	.....	do .....	.....	do .....	do .....	do.
106	.....	○	.....	do .....	.....	do .....	do .....	do.
107	.....	○	.....	do .....	.....	do .....	do .....	do.
108	.....	○	.....	do .....	.....	do .....	do .....	do.
626	.....	.....	.....	do .....	.....	do .....	do .....	do.
966	.....	.....	.....	do .....	.....	do .....	do .....	do.
1234	.....	.....	.....	Maquoket, Iowa.....	.....	Dr. E. C. Bidwell ..	Dr. E. C. Bidwell ..	do.
8691	.....	.....	.....	Mount Carroll, Ill.....	.....	Dr. F. Shimer .....	Dr. F. Shimer .....	do.
7043	.....	.....	.....	Peoria, Ill.....	.....	F. Blahop .....	F. Blahop .....	do.
8134	.....	.....	.....	Burlington, Iowa.....	.....	A. Crocker .....	A. Crocker .....	do.
3155	.....	34	♂	Leavenworth, Kans.....	July 11, 1857	W. M. F. Magraw ..	J. G. Cooper .....	do.
3154	.....	33	♂	do .....	July 11, 1857	do .....	do .....	do.
3153	.....	.....	.....	do .....	July 11, 1857	do .....	do .....	do.
3157	.....	36	♂	do .....	July 11, 1857	do .....	do .....	do.
3156	.....	37	♂	do .....	July 11, 1857	do .....	do .....	do.
14699	.....	9	♂	Fort Riley, Kans.....	.....	H. Brandt .....	H. Brandt .....	do.
12948	.....	.....	.....	do .....	.....	Dr. W. A. Hammond ..	Dr. W. A. Hammond ..	do.

\* In Museum of Comparative Zoology, Cambridge, Mass.

† Approaching var. *palidus*.

TABLE CXXIII.—List of specimens examined of *SPERMOPHILUS TRIDECIMLINEATUS* WAG. PALLIDUS.

Catalogue number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
8422	6501	410	♂	Near Mouse River, Nebr.	Aug. 6, —	General Sully.....	S. M. Rothhammer ..	Skin.
8427				Snatch Creek .....	.....do	.....do	.....do	Skull.
3752		98		Upper Missouri .....	.....do	Gov. I. L. Stevens ..	Dr. Geo. Sackley....	Skin.
1702				Fort Union .....	.....do	Lieut. John Mullan ..	John Pearsall.....	.....do.
				.....do .....	Aug. 12, 1857	Lieut. G. K. Warren ..	Dr. F. V. Hayden....	.....do.
				.....do .....	Aug. 12, 1857	.....do	.....do	.....do.
1771				.....do .....	Aug. 14, 1857	.....do	.....do	.....do.
1764				.....do .....	Aug. 19, 1857	.....do	.....do	.....do.
1765			♂	.....do .....	Aug. 20, 1857	.....do	.....do	.....do.
1772				.....do .....	Aug. 19, 1857	.....do	.....do	.....do.
1767				.....do .....	Aug. 16, 1857	.....do	.....do	.....do.
1769				.....do .....	Aug. 20, 1857	.....do	.....do	.....do.
1770			♂	.....do .....	Aug. 20, 1857	.....do	.....do	.....do.
1766				35 miles from mouth of Yellowstone River.	Aug. 23, 1857	.....do	.....do	.....do.
1768				Fort Berthold, Dak. ....	Sept. 15, 1851	.....do	.....do	.....do.
8421		359	♂	Opposite Ft. Rice, Dak. T.	July 18, —	General Sully.....	S. M. Rothhammer ..	.....do.
3244				Loup Fork .....	.....do	Lieut. G. K. Warren ..	Dr. F. V. Hayden....	.....do.
438			♀	Valley of Platte .....	.....do	Capt. H. Stansbury ..	Capt. H. Stansbury ..	.....do.
3041		19	♀	Platte River .....	June 29, 1857	Lt. F. T. Bryan .....	Dr. W. A. Hammond ..	.....do.
3038		23	♀	.....do .....	July 2, 1857	.....do	.....do	.....do.
3039		25	♀	.....do .....	July 4, 1857	.....do	.....do	.....do.
3040		16	♀	.....do .....	June 27, 1857	.....do	.....do	.....do.
3043		24	♀	.....do .....	July 4, 1857	.....do	.....do	.....do.
3226		49		30 miles east of Laramie	Aug. 24, 1857	W. M. F. Magraw .....	J. G. Cooper .....	.....do.
3220		42		Forks of Platte River..	Aug. 2, 1851	.....do	.....do	.....do.
3730		49	♀	O'Fallon's Bend, Nebr. ....	July 17, 1851	Capt. J. H. Simpson ..	C. S. McCarthy .....	.....do.
3146		54		Fort Laramie .....	Sept. 10, 1851	.....do	.....do	.....do.
3262				West of Laramie, Wyo. T.	Sept. 10, 1857	W. M. F. Magraw .....	C. Drexler .....	.....do.
3260				.....do .....	Sept. 8, 1857	.....do	.....do	.....do.
3061	3310			.....do .....	.....do	Lieut. F. T. Bryan .....	W. S. Wood .....	Skin and skull
3778		14	♂	Green River, Wyo. Ter. ....	Aug. 30, 1870	Capt. J. H. Simpson ..	Capt. J. H. Simpson ..	Skin.
9644		6	♀	Camp Carling, Wyo. Ter. ....	July 24, 1870	Dr. F. V. Hayden....	W. T. Schmidt .....	.....do.
9645		8		.....do .....	July 24, 1870	.....do	.....do	.....do.
9646		10		.....do .....	July 26, 1870	.....do	.....do	.....do.
9647		16		.....do .....	July 27, 1870	.....do	.....do	.....do.
9648		22		.....do .....	Aug. 2, 1870	.....do	.....do	.....do.
9649		26		.....do .....	.....do	.....do	.....do	.....do.
9650		45		.....do .....	Aug. 6, 1870	.....do	.....do	.....do.
9651		57		Cottonwood, Wyo. Ter. ....	Aug. 11, 1870	.....do	.....do	.....do.
9707		342		Little Sandy, Wyo. Ter. ....	Sept. 6, 1870	.....do	.....do	.....do.
9708		363		Big Sandy, Wyo. Ter. ....	Sept. 7, 1870	.....do	.....do	.....do.
9709		371		.....do .....	Sept. 7, 1870	.....do	.....do	.....do.
9710		633		Paseo Creek, Wyo. Ter. ....	Oct. 23, 1870	.....do	.....do	.....do.
9705		635		.....do .....	Oct. 23, 1870	.....do	.....do	.....do.
3268		340		Medicine Bow Mts. ....	July 27, 1857	Lieut. F. T. Bryan ..	W. S. Wood .....	.....do.
3261			♀	Fort Bridger, Utah .....	May 5, 1858	.....do	.....do	.....do.
9653		549		Cheyenne, Wyo. Ter. ....	Aug. 19, 1871	Rocky Mt. Exped. ....	J. A. Allen and C. W. Bennett.	.....do.
9656				.....do .....	Aug. 19, 1871	.....do	.....do	.....do.
9663		1210	♂	.....do .....	Aug. 19, 1871	.....do	.....do	.....do.

\* In Museum of Comparative Zoology, Cambridge, Mass.

TABLE CXXIII.—List of specimens examined of *SP. TRIDECIMLINEATUS* var. *PALLIDUS*—Continued.

Catalogue-number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
*9057	.....	747	....	Park County, Colo. ....	July 14, 1871	Rocky Mt. Exped...	Allen and Bennett.	Skin.
*9058	.....	740	....	do .....	July 15, 1871	do .....	do .....	do.
*9059	.....	989	♂	do .....	July 23, 1871	do .....	do .....	do.
*9060	.....	996	♂	do .....	July 23, 1871	do .....	do .....	do.
*9061	.....	997	♂	do .....	July 23, 1871	do .....	do .....	do.
*9062	.....	998	♀	do .....	July 23, 1871	do .....	do .....	do.
11491	.....	.....	....	Colorado .....	.....	Dr. F. V. Hayden	J. H. Batty	do.
11687	.....	141	....	South Park, Colo. ....	.....	Lieut. G. M. Wheeler	Dr. J. T. Rothrock	Alcoholic.
11688	.....	100	....	do .....	.....	do .....	do .....	Skin.
.....	.....	907	....	Fort Garland, Colo. ....	.....	do .....	H. W. Henshaw	do.
11674	.....	289	....	Denver, Colo. ....	.....	do .....	Dr. J. T. Rothrock	Alcoholic.
437	.....	.....	....	Head of Arkansas .....	.....	Capt. E. G. Beckwith	Mr. Krentsfield	Skin.
516	.....	.....	....	Bent's Fort .....	.....	do .....	do .....	do.
140	.....	.....	....	Eagle Pass, Tex. ....	.....	A. Schott	A. Schott	do.

\* In Museum of Comparative Zoology, Cambridge, Mass.

## SPERMOPHILUS FRANKLINI (Sabine) Lesson.

Franklin's *Spermophile*; Gray-headed *Spermophile*.

*Arctomys franklini* SABINE, Trans. Linn. Soc. xiii, 1822, 587, pl. xxvii; Ibid. Narr. Franklin's Journ. 1822, 602 (Fort Enterprise and Cumberland House).—HARLAN, Faun. Am. 1825, 167.—GOODMAN, Am. Nat. Hist. ii, 1826, 109.—FISCHER, Synop. Mam. 1829, 343.

*Arctomys (Spermophilus) franklini* RICHARDSON, Faun. Bor.-Am. 4, 1829, 163, pl. xii.

*Spermophilus franklini* LESSON, Man. de Mam. 1827, 244.—<sup>1</sup>F. CUVIER, Suppl. Buffon, 1, 1831, Mamm. 328.—WAGNER, Suppl. Schreber's Säuget. iii, 1843, 244, pl. ccc, A ("Arctomys Franklini Sabine" on plate).—BRANDT, Bull. Physico-math. Classe Acad. St. Pétersb. ii, 1844, 379.—AUDUBON & BACHMAN, Quad. N. Am. ii, 1851, 248, pl. lxxxiv.—SCHINZ, Syn. Mam. ii, 1845, 67.—KENNICOTT, Patent Office Rep. 1856, Agricul. (1857), 79, pl. ix.—BAIRD, Mam. N. Am. 1857, 314, pl. xvi, fig. 4 (skull).—THOMAS, Trans. Ill. State Agr. Soc. iv, 1861, 657.—HAYDEN, Trans. Am. Phil. Soc. Phila. xii, 1863, 145.—ALLEN, Proc. Bost. Soc. Nat. Hist. xiii, 1870, 189 (Iowa); xvi, 1874, 291.—BISHOP, Forest and Stream, vii, 1877, 342 (its introduction into New Jersey).

**SPECIFIC CHAR.**—Length to base of tail 9.00 to 10.50; of tail to end of vertebræ 5.00 to 6.50; to end of hairs 6.25 to 8.50. Above, yellowish-brown, varied with black, the black chiefly in the form of small squarish spots; eyelids white; front and sides of head and neck, the thighs, and buttocks pure gray; top of head gray, sometimes varied more or less with yellowish-brown; below, grayish-white; tail grayish-white, with three lines of black, the outer quite broad and broadly edged with white. Ear small, about 0.20 high; tail-vertebræ about one-half the length of the head and body; tail dichous, hairs long and abundant; form rather slender; pelage harsh, consisting of coarse stiff hairs, without under fur.

Different specimens vary in respect to the purity and darkness of the gray on the head and buttocks and in the depth of the yellowish-brown of the upper surface, which latter ranges from pale yellowish-brown to ochry-brown. The Pembina specimens average considerably larger and paler than those from Illinois and Wisconsin and Southern Minnesota. While the southern specimens do not exceed 9.00 in length, the Pembina specimens range generally above 10.00.

This species is one of the most strongly marked of the genus, and cannot, by any possibility, be confounded with any other. It was first described by Sabine in 1822, and subsequently by Richardson, Kennicott, and Baird. Though a common animal of the prairies of Northern Illinois and Wisconsin, it was unknown even to Audubon and Bachman, as late as 1851, except from Sabine's and Richardson's descriptions, and a specimen brought in by Townsend and supposed to have been taken "near the Columbia River". All the earlier descriptions were based wholly on the accounts given by Sabine and Richardson. It has hence fortunately escaped synonyms. It is confined to a narrow belt of country, and specimens are still of rather rare occurrence in collections. Mr. Kennicott, in the Agricultural Report of the Patent Office, has given an excellent and very detailed account of its habits.

It was first described from specimens collected at Fort Enterprise, in about latitude 64°. Sabine also gives it as occurring at Cumberland House. Richardson states that he met with it only in the neighborhood of Carlton House, "where it lives in burrows dug in the sandy soil, amongst the little thickets of brushwood that skirt the plains". He states that it awakens from its winter's sleep about three weeks later than does *S. richardsoni*, which he thinks may be due to the snow lying longer on the shady places it frequents than on the open plains inhabited by the latter.

Mr. Donald Gunn, in notes transmitted with specimens to the Smithsonian Institution, states that its range does not extend much to the eastward of Lake Winnipeg, but that it is numerous to the westward of the lake, where it does considerable injury in the wheat-fields, hoarding up the grain in its burrows for winter use. He says it begins to hibernate about the first of November, and does not reappear till the snow is off in the spring. Dr. Coues found it abundant in the vicinity of Pembina; it also occurs in Minnesota and over the prairie regions of Wisconsin, Illinois, Missouri, and Iowa. Mr. Kennicott also states that Dr. Hoy met with it in Eastern Kansas, and that it is found much further south in Illinois and Missouri than *S. tridecem-*

*lineatus*. It is met with, however, in far less numbers than the latter, and has a greater preference for thickets, low bushes, and borders of timber. It does not appear to extend westward beyond the eastern edge of the great plains, and is hence confined to a rather narrow belt of country, extending from Northern Missouri northward to considerably beyond Great Slave Lake. Audubon and Bachman refer to a specimen obtained by Mr. Townsend, and give the species, on Mr. Townsend's authority, as an inhabitant of Oregon. This is doubtless a mistake, *S. franklini* not having been met with by other observers much to the westward of the Missouri River.

This species also occurs in New Jersey, where it is rapidly increasing in numbers. I learned of its introduction there through Mr. Samuel Jillson, who first wrote me about it some three or four years since. Writing him recently for further information respecting the date and manner of its introduction, as well as for information respecting its present numbers and the area of its range, he has kindly replied as follows, under date of "Tuckerton, New Jersey, May 6, 1877":—"The date of its introduction is May, 1867, when a single pair was brought here by Mr. Sylvester Mathis, from Illinois. This pair soon gnawed out of their cage and escaped. This was in the village of Tuckerton. They are now found in Manahawken, nine miles north of Tuckerton, and also four miles south of Tuckerton, and very likely farther. They are very common on all the farms about here, three miles from the village [of Tuckerton]. They seem to always keep in the fields, as I have never seen them in the woods. I find very little dirt at the mouth of their burrows, sometimes none. From one to two buckets of water poured into their holes will bring them out. We kill all we can on our farm. They destroy young chickens and turkeys, and the dogs dig large holes in our fields in trying to get at the Gophers. I once found one in a salt-hay stack, in spring, dead, coiled up in the smallest ball possible. I also found one dead in my barn-well. I think many of them winter in stacks and under outbuildings, for I could never drown out any late in the fall, in the flat fields. They are never seen here in winter, and no doubt are then dormant. Please excuse my not answering your inquiries sooner, for I wanted to find out the exact date of their introduction."

I am also indebted to Dr. Coues for calling my attention to an article on this subject by Mr. N. H. Bishop, of Lake George, Warren County, New York, dated December, 1876, and published in the *Forest and Stream* newspaper in its issue of January 4, 1877. The facts presented by Mr. Bishop respecting their



introduction and increase in New Jersey are given mainly on the authority of Mr. Jillson, and are fully covered by Mr. Jillson's later and more detailed account already quoted.

From the foregoing, it will be seen that from the single pair introduced accidentally to the fields about Tuckerton in 1867—only ten years ago—the species has spread over a belt of country some thirteen miles in length and probably several miles in breadth, and that its numbers already render it a farm pest, which evidently cannot be soon, if ever, wholly eradicated. It shows, furthermore, that the species is capable of multiplying in a region quite different from its original habitat. Whether the changed conditions will ultimately modify materially its habits and structure remains an interesting question for later investigators.

TABLE CXXIV.—Measurements of seven skulls of *SPERMOPHILUS FRANKLINI*.

Catalogue-number.	Locality.	Sex.	Total length.	Greatest width.	Distance between orbits.	Nasal bones, length.	Nasal bones, width behind.	Nasal bones, width before.	Upper incisors from front to molars.	Upper incisors from front to hinder margin of palate.	Upper incisors, height.	Upper incisors, width between external edges.	Upper molars, length taken together.	Lower jaw, length.	Lower jaw, height.
13288	Pembina, D. T.	♂	2.00	1.17	0.50	0.70	0.25	0.40	0.67	1.07	0.94	0.36	6.37	1.16	0.51
13287	do	♂	2.08	1.17	0.47	0.68	0.27	0.36	0.62	1.06	0.88	0.36	6.41	1.18	0.53
13286	do	♂	1.95	1.10	0.46	0.70	0.25	0.40	0.64	1.04	0.30	0.36	6.37	1.14	0.45
13284	do	♀	1.95	1.10	0.43	0.63	0.25	0.36	0.63	1.03	0.27	0.36	6.41	1.14	0.45
13283	do	♀	1.80	1.06	0.37	0.64	0.18	0.30	0.50	0.98	0.28	0.31	6.41	1.08	0.45
13281	do	---	1.96	1.16	---	0.68	0.25	0.40	0.63	1.05	0.86	0.36	6.41	1.17	0.50
13280	do	---	2.10	1.21	0.49	0.74	0.25	0.40	0.68	1.14	0.28	0.33	6.43	1.22	0.56

TABLE CXXV.—Measurements of twelve specimens of *SPERMOPHILUS FRANKLINI*.

Catalogue-number.	Original number.	Locality.	Sex.	From tip of nose to—				Tail to end of—		Length of—		Height of ear.	Nature of specimen.
				Eye.	Ear.	Occiput.	Tail.	Vertebrae.	Hair.	Fore foot.	Hind foot.		
11592	---	Pembina, D. T.	---	0.95	2.17	2.30	10.75	6.25	7.45	1.35	1.90	---	Fresh.
11593	---	do	♀	0.90	1.80	2.20	9.00	5.00	6.25	1.37	1.95	---	do.
11596	---	do	♂	1.00	2.00	2.25	10.00	5.00	6.60	1.35	1.90	---	do.
11597	---	do	♂	0.95	2.50	2.30	10.00	7.00	8.50	1.35	2.00	---	do.
11601	---	do	♂	1.10	1.90	2.25	9.75	5.00	6.50	1.35	2.00	---	do.
11602	---	do	♂	1.00	2.00	2.35	10.50	5.50	7.00	1.40	2.00	---	do.
*994	---	Lawn Ridge, Ill.	♂	0.98	1.80	2.55	9.30	4.40	6.30	1.27	1.97	0.35	Alcohol.
*911	---	do	♂	0.95	1.75	2.30	9.00	4.85	5.00	1.45	2.13	0.32	do.
*949	---	Peoria, Ill.	♂	0.98	1.85	2.33	8.70	4.55	6.00	1.35	2.05	0.27	do.
*3762	14	Minnesota	♀	0.93	1.78	2.15	8.25	4.35	5.80	1.10	1.90	0.27	do.
*3761	---	do	♂	0.95	1.90	2.35	8.60	---	---	1.15	2.00	0.32	do.
*3619	---	Cook County, Ill.	♂	1.00	1.87	2.35	9.65	4.75	6.25	1.37	2.07	0.35	do.

\* In Museum of Comparative Zoology, Cambridge, Mass.

TABLE CXXVI.—List of specimens examined of SPERMOPHILUS FRANKLINI.

Catalogue-number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
3208				Red River, H. B. T.		D. Gunn	D. Gunn	Skin.
3207				do		do	do	do.
3018				do		do	do	do.
3785				do		do	do	do.
11583	3149			Pembina, Dak. Ter.	June 24, 1873	A. Campbell	Dr. E. Coues	do.
11584	3180	♀		do	June 23, 1873	do	do	do.
11585	3097	♂		do	June 23, 1873	do	do	do.
11586	3137	♂		do	June 24, 1873	do	do	do.
11587	3003	♀		do	June 23, 1873	do	do	do.
11588	3151	♀		do	June 24, 1873	do	do	do.
11589	13331			do	June 24, 1873	do	do	Skin and skull.
11590	3154	♀		do	June 24, 1873	do	do	Skin.
11591	3273	♂		do	June 5, 1873	do	do	do.
11592	13383	3085	♂	do	June 23, 1873	do	do	Skin and skull.
11593	13393	3148	♀	do	June 24, 1873	do	do	do.
11594	13394	3153	♀	do	June 24, 1873	do	do	do.
11595	13395	3190	♀	do	June 23, 1873	do	do	do.
11596	13396	3153	♂	do	June 24, 1873	do	do	do.
11597		3096	♂	do	June 23, 1873	do	do	Skin.
11598	13397	3094		do	June 23, 1873	do	do	Skin and skull.
11599		3190	♀	do	June 23, 1873	do	do	Skin.
11600	13398	3098	♂	do	June 23, 1873	do	do	Skin and skull.
11601		3093	♀	do	June 14, 1873	do	do	Skin.
11602		3150	♂	do	June 24, 1873	do	do	do.
11603				do	June 23, 1873	do	do	do.
11599		3351		Saint Paul, Minn.	May 19, 1873	do	do	do.
192	1885			Racine, Wis.		Dr. F. R. Hoy	Dr. F. R. Hoy	Skin and skull.
6686				Mount Carroll, Ill.		do	H. Shimer	do.
1403	9306			West Northfield, Ill.		do	R. Kennicott	do.
3040	3069			do		R. Kennicott	do	do.
3653				Loup Fork, Nebr.		Dr. F. V. Hayden	Dr. F. V. Hayden	Skin.
*3761	1			Minneapolis, Minn.		Horace Mann, jr.	Horace Mann, jr.	Alcoholic.
*3789	14			do		do	do	do.
*3481				Evanston, Ill.		Prof. O. Marey	Prof. O. Marey	do.
*3482				do		do	do	do.
*3019				do		do	do	do.
*994				Lawn Ridge, Ill.		Hendrick Butler	Hendrick Butler	do.
*911				do		do	do	do.
*949				Peoria, Ill.		A. Ordway	A. Ordway	do.
				Tuckerton, N. J.		B. Jilison	B. Jilison	Skin.

\* In Museum of Comparative Zoology, Cambridge, Mass.

## SPERMOPHILUS ANNULATUS Aud. &amp; Bach.

Annulated-tailed *Spermophile*.

*Spermophilus annulatus* AUDUBON & BACHMAN, Journ. Acad. Nat. Sci. Phila. viii, 1842, 319; Quad. N. Amer. II, 1851, 213, pl. lxxix. See also BAIRD, Mam. N. Amer. 1867, 397.

*Sciurus rufobrachiatum* MURRAY, Geog. Distr. Mamm. 1866, 354 (not *Sciurus rufobrachiatum* Waterhouse).  
? *Sciurus lewisii* H.-SMITH, Griffith's Cuvier's An. King. III, 1827, 190, and plate.

**SPECIFIC CHARs.**—Length of head and body 9.50; of tail to end of vertebræ 6.50; to end of hairs 9.00; hind foot 2.10; fore foot 1.15; height of ear 0.50. Above, coarsely varied with yellowish-brown and black; top of head black, varied slightly with yellowish-brown; sides of the head, neck, shoulders, outer surface of fore limbs, and upper surface of hind feet dark reddish-brown or chestnut; sides of the nose and a ring around the eyes light brownish-yellow; beneath, pale straw-yellow, more brownish anteriorly and on the edges of the thighs. The color of the dorsal surface extends low down on the sides of the body, the blackish tint involving the basal portion of the hairs even on the abdomen. Lower surface of the tail nearly uniform reddish-cinnamon, with an interrupted narrow black border edged with yellowish; upper surface banded transversely with black and yellowish-white, the black bars rather the wider and about fifteen in number, becoming indistinct on the basal portion of the tail.

The general form of the body is highly Sciurine. The ears are broad, fully half an inch high, and well rounded above. The tail with the hairs is nearly as long as the body, flat and distichous, but rather narrow. Claws short, strong, and more highly curved than in any other of the American *Spermophiles* (except perhaps *S. grammurus*), having nearly the form seen in *Sciurus*. The pelage is sparse, coarse and stiff, and without under fur. The hairs of the dorsal surface are grooved above, black, ringed once near the tip with pale yellowish-brown.

The only specimen of this animal that I have seen is a skin, in excellent condition, of an adult female, in summer pelage, collected on the Plains of Colima, Western Mexico, in 1863, by Mr. John Xantus.\* Judging from the characters afforded by the skin, this species belongs to the subgenus *Otospermophilus*, but in some features is rather more Sciurine than even *S. grammurus*, its nearest ally. The ears, though large, are less pointed than in that species, and the tail less bushy; the claws are short, deep, and much

\* It bears the National Museum number 7018; original number 134.

curved. The pelage is coarser, much harsher and stiffer even than in *Spermophilus grammurus*, and the hairs are, in like manner, conspicuously grooved above. The transverse barring of the tail distinguishes this species among all the American *Sciurida*.

This species was first described by Audubon and Bachman, in 1842, in the Journal of the Academy of Natural Sciences of Philadelphia. These authors republished their description, with a figure, in their Quadrupeds of North America, in 1851. The single specimen that served as the basis for their description and figure was presented to them by Professor Baird, respecting which these authors say:—"The specimen we have described was obtained on the western prairies; the locality was not particularly stated. It was politely presented to us by Mr. Spencer F. Baird, of Carlisle, Pennsylvania."\* In republishing this account nine years later, they add, after the word prairies, "we believe on the east of the Mississippi River".† Professor Baird, in alluding to this species in 1857, says:—"The animal described under this name [*Spermophilus annulatus*] by Audubon and Bachman was purchased by me from a dealer many years ago and presented to Mr. Audubon. It was supposed to have been brought from the west, and, as such, was described by the above authors. I have, however, little doubt that it is an African species of *Sciurus*, and, in fact, it resembles closely, if it be not identical with, the *Sciurus rufobrachiatus* of Fraser, in Zoologia Typica, said by him to be closely related to the *Sciurus annulatus* of Western Africa. In any event, it must be eliminated from the list of North American Spermophiles."‡

Andrew Murray, in 1866, referred this species to *Sciurus rufobrachiatus* of Waterhouse, and speaks of it as follows:—"Dr. Baird says that Audubon and Bachman had been deceived in the locality of the species which they described under this name [*Spermophilus annulatus*], supposing it to have been an American Spermophile, while, in fact, it was a West African Squirrel."§

Here, at last, it is positively asserted to be a West African species, and is referred to the genus *Sciurus*. It is, however, not only a true Spermophile, but proves to be beyond question an inhabitant of the Plains of Western Mexico. The original type of the species appears to have been lost. From Audubon and Bachman's very careful description and figure of it, there can

\* Journ. Acad. Nat. Sci. Phila. vol. viii, p. 223.

† Mam. N. Amer. p. 327.

‡ Quad. N. Amer. vol. ii, p. 215.

§ Geog. Distr. Mam. p. 354.

be no doubt of its identity with Mr. Xantus's specimen above described. The only discrepancies consist in Audubon and Bachman's specimen being a little smaller than the present one, and the tail is represented as being relatively a little longer and the color of the ventral surface of the body a little lighter, but in every other detail of structure and coloration there is the closest agreement. Although evidently a true *Spermophile*, in all probability referable to the subgenus *Otospermophilus*, the absence of the skull renders it impossible to refer it to any particular section of the genus *Spermophilus*.

In 1827, Major Hamilton-Smith, in Griffith's *Cuvier's Animal Kingdom* (vol. iii, p. 190), described and figured a "*Sciurus lewisii*", said to have been based on a specimen in "Mr. Peal's Museum in Philadelphia, . . . brought there by the American Missouri travellers, Messrs. Lewis and Clarke", the name being given in honor of Captain Lewis. The figure and description strongly recall the present species.\* The tail is similarly barred transversely (but the bars are fewer and broader), and the general color seems to resemble that of the *Spermophilus annulatus* of Audubon and Bachman. Professor Baird has very doubtfully referred the *Sciurus lewisi* to *Sciurus "tudovicianus"*, supposing that the barring of the tail might have been due to a twisting of that member. He expresses himself as at a loss to account for the absence of red in the tail, but says that unless it be assignable to this species he cannot refer it to any known North American species. If, however, Hamilton-Smith's figure be considered as at all trustworthy, his "*Lewis's Squirrel*" bears a much nearer resemblance to the *Spermophilus annulatus* than to any other known species of *Sciuridae*. If really to be referred to this, the specimen was probably not "brought to Philadelphia" by Lewis and Clarke, but was doubtless derived from some wholly different source.

Hamilton-Smith traces a resemblance between his animal and the *Sciurus annulatus* described in 1822 by Desmarest from a specimen in the Paris

\* The description is as follows:—"Lewis's Squirrel has the upper part of the head, neck, shoulders, fore arms, to the articulation of the arm, backs flanks [*sic*], the posterior moiety of the thighs, and a band round the belly, of ochrey gray colour; all the under parts, the inside of the limbs, and the paws are pure ochrey; the ears are small, round, and far back; the eyes are black. It surmounted with the same colour as the back; the nostrils open at the extremity of the muzzle, forming a denuded black snout, the upper lip is white, and the whiskers very long; the tail is very beautiful, entire. It is black or bushy cylindrical and annulated, with seven black and six white bands, with the terminations black." They add,—"This appears to be the *Sciurus annulatus*, described by M. Desmarest, *Encyclopédie Méthodique*, article *Mammalogie*, from a specimen in the museum at Paris, whose habitat is unknown. His specific characters, however, are fur of a bright-greenish-gray above, without lateral white bands, white underneath, tail longer than the body, round, annulated, black and white; of the size of the Palm Squirrel. These differences of colour may be sufficiently accounted for, to reconcile the probability of the identity of the species of these two specimens."

Museum from an unknown locality, to which species it is finally doubtfully referred in volume V (p. 257). The latter, however, has since been identified by Temminck and others as one of the West African annulated-tailed species of *Sciurus*. It is possible that the specimen described by Hamilton Smith had also an African origin, though it seems to much better agree with *S. annulatus* than with any of the African annulated-tailed Squirrels.

NOTE.—In 1853, Audubon and Bachman, in the third volume of their *Quadrupeds of North America* (p. 65), described a *Spermophilus pealei*, introducing the species into their work with the remark that they could not with certainty "add it to the list of our North American mammals", the locality of the specimen being unknown to them. They add, however, that they could not identify the specimen with any Old World species known to them, "whilst, on the other hand, it bears in form, size, and markings, a strong connection with the American Spermophiles, and will, we are inclined to think, yet be found in some part of the western sea-coast regions of America". Later, on the last page of the same volume (last line), they say "*Spermophilus pealei*.—Not American." In the introduction to their description of the species (*l. c.* p. 64), they state that they received the specimen from one of the naturalists of the Wilkes Exploring Expedition shortly after the return of the expedition to the United States. As clearly shown by their description, their *Spermophilus pealei* was based on a specimen of *Sciurus palmarum* (auct.) of India, an animal having many affinities with the genus *Tamias*.

#### GENUS CYNOMYS Raf.

*Arotomys* (in part) of various authors.

*Spermophilus* (in part) of various authors.

*Cynomys* RAFINESQUE, Amer. Monthly Mag. ii, 1817, 45. Based on the "Barking Squirrel" of Lewis and Clarke, = *Arotomys ludovicianus* Ord.

*Anteomys* RAFINESQUE, Amer. Monthly Mag. ii, 1817, 45. Based on the "Burrowing Squirrel" of Lewis and Clarke, = *Arotomys columbianus* Ord. (also included a species of a different family, "*Aploodontia leporina*" auct.).

GENERIC CHAR.—Skull rather short, very broad, highly arched, and massive; zygomatic arches greatly expanded and strongly divergent posteriorly; malar bone nearly straight, rather broad and thin, its plane of expansion nearly horizontal, dipping slightly inward; postorbital processes long, strong, decurved; muzzle rather long, abruptly contracted at the front border of the maxillaries, its sides parallel; anteorbital foramina rather large, subtriangular,

thrown outward basally, the bony plate forming their outer border being oblique to the vertical plane of the skull; upper premolars two, the first large, of the same breadth antero-posteriorly as the other grinding teeth (excepting the last molar); dentition heavy, the grinding teeth (except the first premolar and last molar) with the transverse breadth twice the antero-posterior; the last molar much larger than the others, subtriangular, the anterior and inner borders straight, the postero-outer rounded; molar series strongly convergent posteriorly; cheek-pouches moderaté; tail very short, flattened; ears rudimentary; pollex large, with a well-developed nail; pelage short, full, and soft, especially in winter; coloration without spots or streaks.

*Cynomys* is the most highly specialized generic group among the American *Sciuridae*. It is especially characterized by its massive dentition, which is heavier than that of any other Sciuromorph with which I am acquainted, and by the great posterior convergence of the upper molar series. In other features, it differs little from *Colobotis*, possessing only the characters of that group, particularly as represented in its most specialized phase (for instance, as in our *Spermophilus* [*Colobotis*] *richardsoni* and in *S.* [*Colobotis*] *brevicauda* of Siberia), in an exaggerated degree. The grinding teeth, however, are set more obliquely in the jaw (those of the upper jaw being directed strongly outward, and those of the lower jaw in the opposite direction), while the teeth themselves are relatively shorter and broader, with three instead of two transverse grooves in the outer half of the triturating surface (in the maxillary series). The palate is slightly narrowed posteriorly in *Spermophilus*, but in *Cynomys* its breadth between the last molars is less than half its width between the first premolars. The general outlines of the skull, both in profile and as seen from above, differ little from those of *Spermophilus*, the difference in this respect being not greater than between different species of either the subgenera *Colobotis* or *Ictidomys*. The occipital, interparietal, and temporal crests are, however, much more strongly developed than in any of the *Spermophili*, and all the processes and ridges of the lower jaw are much more prominent. The general form of the lower jaw is quite similar to that of *Spermophilus*, especially as met with in the heavier forms of the subgenus *Colobotis*; the coronoid process, however, is shorter, stouter, and has a much greater antero-posterior breadth, and the angular process is more produced. The mental foramen is placed lower than in most species of *Spermophilus* and *Arctomys*, but not lower than in some of them (*S. brevicauda* for example), its position being midway between the upper and lower edges of the jaw.



In *Cynomys*, the edges of the orbits are raised above the plane of the frontals, as in several of the species of the subgenus *Colobotis*, but rather more strongly, and the anterior face of the zygomatic process of the maxillary is deeply excavated. The breadth of the skull at the posterior border of the zygomatic arches is equal to or greater than the length of the skull, exclusive of the portion anterior to the front edge of the maxillaries, and hence much greater than in any other genus of the *Sciuridæ*. All the teeth are relatively large and heavy; the grinding teeth are narrowed on the inner border, as in *Spermophilus* and *Arctomys*. The molar series occupy about one-third the entire length of the skull. The incisors are short and strong, with the antero-posterior breadth nearly twice the transverse.\*

The genus *Cynomys* was proposed by Rafinesque in 1817, and based wholly on the description of the "Barking Squirrel" of Lewis and Clarke, which he named *Cynomys socialis*. He also doubtfully referred to it a "*Cynomys grisea*", based on the "Petit Chien" of the Upper Missouri, incidentally mentioned by Lewis and Clarke. This is merely another name for the Barking Squirrel of the same authors (= *Arctomys ludovicianus* Ord, = *Cynomys ludovicianus* Baird). In the same article (and on the same page), Rafinesque also proposed the genus *Anisonyx*, based primarily on the description of the "Burrowing Squirrel" of Lewis and Clarke (= *Arctomys columbianus* Ord, = *Cynomys gunnisoni* Baird), but which was made to include also their "Sewellel" under the name *Anisonyx rufa*, which belongs to a wholly different family (*Haplodontidæ*). The genus is based on wholly false characters, resulting from Rafinesque's misinterpreting Lewis and Clarke's description, and, as far as the present group is concerned, is preoccupied by *Cynomys*. The first species referred to it is the *Anisonyx brachiura*, equal to the *Arctomys columbianus* of Ord of two years' earlier date, based on the same description.

The genus *Cynomys* is restricted to the parks and plains of the great Rocky Mountain Plateau, and is represented, so far as known, by only two species.

\* The food of *Cynomys* consisting of soft herbaceous plants and grasses and succulent roots, the large size of the teeth and their very firm implantation offer a puzzling problem. The great antero-posterior breadth of the incisors, the heavy, strong molars, and all the provisions of the skull for muscular attachment indicate great strength of jaw and cutting power—far greater even than in the true Squirrels, whose food consists largely of hard nuts. The species of *Cynomys* live on the open, barren plains, generally where the coarsest plants are annuals, with stalks rarely thicker than one's finger, and the only suffrutescent vegetation is the various forms of *Artemisia*, *Obione*, etc. Where the eastern *C. ludovicianus* most abounds, there is apparently nothing for it to feed upon requiring great strength of jaw or heavy dentition. Yet it presents the heaviest dentition and greatest masticatory power met with among the *Sciuridæ*.



## CYNOMYS LUDOVICIANUS (Ord) Baird.

## Missouri Barking Squirrel; Missouri "Prairie Dog".

- Arctomys ludovicianus* "ORD, Guthrie's Geog. 2d Am. ed. ii, 1815, 292, 302."—SAY, Long's Exped. Ry. Mts. i, 1823, 451 (description), 498 (villages).—HARLAN, Faun. Am. 1825, 160.—GODMAN, Am. Nat. Hist. ii, 1826, 114.—H. SMITH, Griffith's Cuvier's An. King. iii, 1827, 108 (with an original but very erroneous figure from Lewis and Clarke's specimen); v, 1827, 247.—PRINCE MAX, Reise in d. in. Nord-Amer. i, 1830, 365.—WAGNER, Suppl. Schreber's Säuget. iii, 1843, 361.—SCHINZ, Syn. Mam. ii, 1845, 64.—STANSBURY, Salt Lake Exped. 1852, 37.
- Spermophilus ludovicianus* LESSON, Man. de Mam. 1827, 244.—"F. CUVIER, Suppl. Buffon's Hist. Nat. i, Mamm. 1831, 316."—AUDUBON & BACHMAN, Quad. N. Am. ii, 1851, 319, pl. xcix.—MARCY, Red River Exped. 1853, 46.—WOODHOUSE, Sitgreaves's Expl. Zuni and Colorado Rivers, 1853, 52.—KENNICOTT, U. S. Pat. Off. Rep. Agricul. 1856 (1857), 81, pl. ix.
- Cynomys ludovicianus* BAIRD, Mam. N. Am. 1857, 331, pl. xlvii (skull and dentition); U. S. and Mex. Bound. Surv. ii, 1859, pt. iii, 39.—SUCKLEY, Nat. Hist. Wash. Ter. pt. iii, 1859, 99, 123.—THOMAS, Trans. Ill. State Agr. Soc. iv, 1860, 657 (Illinois [?]).—MAXIMILIAN, Arch. f. Naturgesch. 1861, 88.—HAYDEN, Trans. Am. Phil. Soc. Phila. xii, 1863, 145.—STEVENSON, Hayden's Rep. U. S. Geol. Surv. Wyom. 1871, 462.—ALLEN, Bull. Essex Institute, vi, 1874, 49 (biographical); Proc. Bos. Soc. Nat. Hist. xvi, 1874, 294; xvii, 1874, 43.—GRINNELL, Ludlow's Rec. Black Hills of Dakota, 1875, 82.—MERRILL, Forest and Stream, vi, 1876, 369 (habits).—"PLUME DEL ROSA", ib. vii, 1876, 52 (domestication).
- Cynomys socialis* RAFINESQUE, Am. Month. Mag. ii, 1817, 45 (= "Barking Squirrel", Lewis and Clarke).
- Cynomys grisea* RAFINESQUE, Am. Month. Mag. ii, 1817, 45 (= "Petit Chien", Lewis and Clarke).
- Arctomys grisea* FISCHER, Syn. Mam. 1829, 345 (from Rafinesque).
- Arctomys missouriensis* WARDEN, Descrip. États-Unis, v, 1820, 627 (= "Wiahtonwiah", Pike).—DESMAREST, Mam. 1822, 329 (from Warden).
- Arctomys latrans* HARLAN, Faun. Amer. 1825 306 (= "Barking Squirrel", Lewis and Clarke).—FISCHER, Syn. Mam. 1829, 345 (from Harlan).
- Petit Chien*, LEWIS & CLARKE, Travels, 1st Am. ed. i, 1815, 68.
- Prairie Dog*, LEWIS & CLARKE, Travels, i, 1815, 67.—KENDALL, Nar. Santa Fé Exped. i, 1844, 182.—GREGG, Commerce of the Prairies, ii, 1845, 228.
- Barking Squirrel*, LEWIS & CLARKE, Travels, 1st Am. ed. ii, 1815, 175; 4to Lond. ed. 1815, 469; 8vo Lond. ed. iii, 1815, 38.
- Wiahtonwiah*, or *Prairie Squirrel*, PIKE, Travels, 1810, 156, 180.
- Marmotte du Missouri*, WARDEN, l. c.
- Louisiana Marmot*, SAU. l. c.
- Prairie Marmot*, GODMAN, l. c.
- Wiahtonwiah*, RICHARDSON, l. c.
- Missouri Prairie Dog*, BAIRD, l. c.

**SPECIFIC CHARs.**—Length of head and body 11.50 to 12.50, ranging from about 11.00 to 13.00; tail to end of vertebrae 3.00 to 4.00; tail to end of hairs 4.00 to 5.00. Above reddish-brown, varied with gray, and with a few hairs wholly black; below yellowish- or brownish-white. Tail short, flattened, basally above like the back, and brownish-black toward the end, the dusky hairs more or less whitish at base. Ears very small, rounded, about one-fifth of an inch high. Claws long and strong, but little curved; that of the thumb well developed. The character of the pelage varies considerably with the season, being much finer and softer in winter than in summer.

In specimens taken in June and July, the pelage is quite short, some-

what harsh, and rather stiff, with very little under fur, particularly at the southward. Autumnal specimens (including some taken as early as August 23), on the other hand, have a very full, soft pelage, with an abundance of whitish, very fine, silky under fur. The hairs of the dorsal surface are generally black at the extreme base, then very broadly ringed with whitish or grayish-white, followed by a broad zone of reddish-brown, with the extreme tips of the hairs whitish. There are also intermixed, sometimes sparsely, sometimes abundantly, longer hairs, generally wholly black to the base. These are sometimes so abundant as to give a blackish cast to the dorsal surface, particularly on the top and sides of the head and sides of the neck. The color also varies somewhat with season, specimens taken late in autumn being more hoary above and more fulvous on the sides and below than those taken in early summer. Between specimens in winter pelage from the north (Fort Randall) and those in summer pelage from the south (Kansas, Colorado, and Texas), the difference in the color and texture of the pelage is very striking. In the northern specimens, the pelage is full, very soft and silky, yellowish-brown, rather strongly varied with dusky; in the southern specimens, the pelage is shorter and harsher, brownish-red, varied with intense shining black. In some examples (as No. 1651, from Fort Chadbourne, Texas, and No. 9557, from Soda Springs, Colo.), the color is nearly brick-red. There is also considerable variation in size with locality, there being a strongly marked decline southward, as shown by the subjoined tables of measurements.

The present species differs from *Cynomys columbianus* in its more reddish coloration, longer and differently colored tail, and larger size. In respect to the skulls, aside from the difference of size, the nasals, as a rule, extend further back in *C. ludovicianus* than in *C. columbianus*, and the zygoma is thicker and narrower, in strong contrast with the broad, thin plate seen in *C. columbianus*. By size alone, large skulls of *C. columbianus* cannot be certainly distinguished from small skulls of *C. ludovicianus*.

This species, like the following, was first brought to the notice of naturalists by Lewis and Clarke, who met with it on the plains of the Upper Missouri during their journey from Saint Louis to the Rocky Mountains and the Pacific Ocean, in 1804, 1805, and 1806. In the first volume of the "Biddle-Allen" Narrative of Lewis and Clarke's Expedition,\* published in 1815,

\* See Dr. Elliott Coues's "An Account of the various publications relating to the Travels of Lewis and Clarke, with a Commentary on the Zoological Results of their Expedition" (Bull. U. S. Geol. and Geogr. Survey of the Terr. 2d ser. No. 6, Feb. 8, 1876) for an exhaustive and useful descriptive summary of the various narratives of the Lewis and Clarke expedition.

it is variously referred to incidentally as the "Petit Chien", "Prairie Dog", "Barking Squirrel", and "Burrowing Squirrel", and is described at length in volume ii (p. 175) under the name "Barking Squirrel". In Gass's Narrative of the same expedition, published in 1807, it is briefly referred to as the "Prairie Dog". Pike, in his account of his travels on the Missouri and Arkansas Rivers, in 1805 and 1806 (published in 1810), also refers to it as the "Wishtonwish", or "Prairie Squirrel", and gives much information respecting its habits. To the animal described under the name "Barking Squirrel", in the second volume of the "Biddle-Allen" narrative of the Lewis and Clarke expedition, Ord, in 1815, gave the name *Arctomys ludovicianus*, basing the name on Lewis and Clarke's description. Say, in 1823, under the same name, gave a somewhat fuller account of its habits, and described the species from a specimen brought from the Upper Missouri, many years before, by Lewis and Clarke. In the mean time, Rafinesque, in 1817, renamed the Barking Squirrel of Lewis and Clarke (= *Arctomys ludovicianus* of Ord and Say) *Cynomys socialis*, basing both the genus and the species on Lewis and Clarke's description. Rafinesque, in the same paper, also gave the name "*Cynomys? grisea*" to Lewis and Clarke's "Petit Chien" of the Upper Missouri, which is identical with their "Prairie Dog" and "Barking Squirrel". Later, in 1825, Harlan, while recognizing the *Arctomys ludovicianus* of Ord and Say, and referring to it the Prairie Dog of Lewis and Clarke, gave the name *Arctomys latrans* to Lewis and Clarke's Barking Squirrel of "the plains of the Missouri", thus adding another nominal species to the two introduced by Rafinesque. Neither Rafinesque's names nor that proposed by Harlan have received recognition except in the works of a few foreign compilers.

As already shown, this species was first met with by Lewis and Clarke, during their journey up the Missouri River in 1804, while Pike met with it the following year on the Arkansas River. The first published reference to it appears to have been made by Gass, in 1807, who gives, however, no information of importance respecting it. Pike, in 1810, gave a more detailed account of its habits, while Say, in 1823, further contributed to its biography and gave of it the first formal scientific description. It has since been well described by various authors, and may be considered as one of the best known of our smaller Mammals. It figures largely in the accounts of all

travellers across the Plains, from the time of Pike down to the present day. Among the more noteworthy notices are those of Kendall,\* Gregg,† Stansbury,‡ and Marcy.§ Many of these popular accounts are more or less mixed with error, owing to the natural tendency, especially among unscientific writers, to exaggerate whatever borders on the marvellous. Errors, however, have crept into the accounts of even scientific observers, the very names of "Prairie Dog", "Petit Chien", etc., being grossly misleading. These terms, together with those of "Dog-towns", "Prairie Dog villages", etc., as applied to the colonies of these animals, can doubtless never be eradicated from vernacular parlance. As long since noted by Say, the "absurd and inappropriate name of Prairie-dog" was given to this animal "from a fancied resemblance of its warning cry to the hurried barking of a small dog". Its "bark", however, is strictly that of a Squirrel, bearing really little resemblance to that of any species of *Canis*. The absurd theory, so widely current, that it harmoniously shares its burrow with the rattlesnake and owl,||

\* Narrative of the Texan Santa Fe Expedition, vol. i, p. 188 (1844). A very sensible, amusing, and graphic account.

† Commerce of the Prairies, vol. ii, p. 228 (1845).

‡ Salt Lake Exped. p. 37 (1852).

§ Red River Exped. pp. 46-49. A very good account of its habits.

|| Pike, apparently the first to make reference to this matter, says:—"Strange as it may appear, I have seen the 'Wishtonwiah', the rattle-snake, the horn frog, of which the prairie abounds, . . . . and a land tortoise all take refuge in the same hole. I do not pretend to assert, that it was their common place of resort, but I have witnessed the above facts more than in one instance."—(*Journal of a Voyage to the Arkansas*, etc. 1810, p. 156, foot-note.) Lewis and Clarke, in their account of the "Petit Chien", also state:—" . . . we discovered, however, two frogs in the hole, and near it we killed a dark rattlesnake, which had swallowed a small prairie dog: we were also informed, though we never witnessed the fact, that a sort of lizard, and a snake, live habitually with these animals."—(*Travels*, 1st Am. ed. vol. i, p. 68, 1815.)

Among the many references to this subject, see further the articles cited in the preceding foot-notes; also my own article on this species in *Proc. Essex Institute* (vol. vi, pp. 49-52), and the following: Maj. J. W. Merrill, in *Forest and Stream* (newspaper), issue of July 13, 1876; "Plume del Rosa", in the same (issue of August 31, 1876); and Lieut. C. A. H. McCauley, in *Bull. U. S. Geol. and Geog. Surv.* vol. iii, 1877, pp. 680-683. It may be well, however, to add that the Prairie Owls (*Speotyto cunicularia* var. *hypogæa*) are merely occupants of deserted burrows, which offer them a convenient home. While their food consists largely of insects ("grasshoppers") and crawfishes, some have supposed that they also prey upon the young dogs, but I have met with no proof that such is the case. On the other hand, the Rattlesnakes (*Crotalophorus confluentus*) bring terror to these little Marmots whenever they appear, upon which they largely subsist. They usually, however, make their home in one particular burrow, from which they may have driven the rightful owner, but doubtless enter others in search of food. The holes occupied by the Marmots, the Owls, and the Rattlesnakes are, respectively, readily distinguishable by evident external signs. (See further, *Bull. Essex Inst.* vol. vi, pp. 49-51.)

The "Prairie Dog" is readily susceptible of domestication, and makes an agreeable and amusing, though sometimes a rather mischievous, pet. None of the animals in the Zoological Gardens of Philadelphia probably afford greater pleasure or are of greater interest to visitors than the considerable colony of these animals there successfully domesticated. (On the "Prairie Dog" as a pet, see the article by "Plume del Rosa" in the *Forest and Stream* (newspaper) of August 31, 1876.)

though discredited by Say and every naturalist since his time who has had the opportunity of becoming personally familiar with the animal on its native plains, is hardly less difficult to eradicate from the popular mind than the idea that it is in reality a sort of small dog, as its common vernacular name implies.\*

The habitat of the present species is confined to the dryer portion of the plains east of the Rocky Mountains, where it is found from Western Texas northward to the forty-ninth parallel. The eastern limit of its range is near the ninety-eighth meridian. Specimens are in the collection from Fort Chadbourne, the Staked Plains, and other localities in Western Texas, and from near the Pecos River in Southeastern New Mexico. It ranges over the western half of Kansas and thence westward in Colorado to the foot-hills of the Rocky Mountains, beyond which I have been unable to trace it, it being immediately replaced in the Park to the westward by *C. columbianus*. In Wyoming, it ranges westward over the Laramie Plains, and even to the sources of the North Platte. Further northward, it likewise appears to uniformly reach the eastern base of the Rocky Mountains, beyond which the species apparently does not extend. It is found, according to Dr. Hayden, as far down the Missouri as the mouth of the White River (in about latitude 43° 40'), near which point it was first met with by Audubon in his ascent of that river in 1843. It occurs thence northward and westward over the plains of the Yellowstone and Missouri, but over large areas of the more barren portions its settlements occur only at infrequent intervals. At more favorable localities, they occupy the country continuously over hundreds of square miles. It has been met with by both Dr. Suckley and Dr. Coues on the Milk River. Respecting the northern limit of its range Dr. Coues kindly adds the following:—

"I have no personal knowledge of the Prairie-dog beyond 49°, the northern boundary of Montana, and Richardson speaks of it as restricted to the Missouri Basin. During my connection with the U. S. Northern Boundary Commission, in 1873-'4, when I passed along the parallel of 49° from the Red River of the North to the Rocky Mountains, I observed no

\* The highest absurdity of misrepresentation is reached in Hamilton-Smith's "original figure", in Griffith's *Cuvier's Animal Kingdom* (vol. III, plate facing p. 196), drawn (it is said) from the specimen brought to Philadelphia by Lewis and Clarke. In this figure is represented the muzzle of a pug-nosed dog, between the half-open lips of which are seen an uninterrupted row of teeth, resembling those of a carnivorous animal!

'Dogs' in any portion of the Red River Basin, and the probability is that the animal has made little if any settlement so far eastward in this latitude. I found some small colonies, however, at various points in the Milk River region, which may really be the limit of dispersion to the northward. The most extensive establishment was in a tolerably fertile depression of the prairie just east of Frenchman's or White Earth River, about lat.  $48^{\circ} 30'$ , and not far from the mouth of Milk River. The owls, *Speotyto hypogaea*, rattlesnakes, *Crotalus confluentus*, and horned frogs, *Phrynosoma douglassi*, are also inhabitants of the same area, though never seen in the Red River water-shed. These four animals, and the Sage Cock, *Centrocercus urophasianus*, are almost diagnostic of the Missouri Basin as distinguished from that of the Red River."

At the southward, according to Lieutenant Abert, as quoted by Audubon and Bachman, this animal "does not hibernate, but is out all winter, as lively and as pert as on any summer day". Gregg also states that he had good authority for the statement that they are always abroad in winter during fine weather. According to Lewis and Clarke, however, "as soon as the frost commences, they shut themselves up in their caverns, and continue till the spring opens". Say also says that "they pass the winter in a lethargic sleep", defending themselves from the inclemency of the season "by accurately closing up the entrance of the burrow". This is doubtless a mistake, as, in January, 1872, I met with them in Northwestern Kansas as active on bright sunny days as in summer, they only retiring for a few days at a time during the severest weather. Further northward, where the climate is more severe, they are doubtless less active in winter than further southward, retiring to their burrows for longer periods.

TABLE CXXVII.—Measurements of thirty one specimens of *CYNOMYS LUDOVICIANUS*.<sup>a</sup>

Catalogue-number.	Original number.	Locality.	Sex.	From tip of nose to—			Tail to end of—		Length of—		Nature of specimen.	Remarks.	
				Eye.	Ear.	Occiput.	Tail.	Vertebrae.	Hairs.	Fore foot.			Hind foot.
11934	4196	Near mouth of Milk River	♂	1.25	2.25	2.75	19.75	3.25	4.25	1.00	2.40	Fresh.	
1815	.....	Yellowstone River, Mont.	♂	1.13	2.38	2.90	11.00	2.63	2.38	.....	2.25	do	
1816	.....	do	♂	1.25	2.63	3.25	13.00	3.00	3.88	2.00	2.25	do	
1317	.....	do	♂	1.13	1.43	2.75	11.00	2.75	3.75	2.00	2.25	do	
.....	.....	Fort Randall, Dak. Ter.	♂	1.41	3.00	3.50	12.25	3.63	4.00	2.13	2.38	do	
1903	.....	do	♀	1.25	2.50	3.50	13.00	4.00	5.00	2.00	2.38	do	
.....	.....	do	♀	1.25	2.50	3.70	12.50	4.00	4.75	2.00	2.25	do	
1107	.....	do	♂	1.13	2.25	3.25	12.50	3.25	4.25	1.75	2.25	do	
.....	.....	do	.....	1.13	2.25	3.25	12.00	3.00	4.0	1.75	2.13	do	
1819	.....	do	.....	1.13	2.25	3.25	12.25	3.13	4.13	1.75	2.13	do	
.....	.....	do	.....	1.13	2.25	3.25	12.25	3.13	4.13	1.75	2.00	do	
1814	.....	do	.....	1.11	2.25	3.25	11.25	3.00	3.90	1.50	2.25	do	
.....	.....	do	.....	1.25	2.50	3.25	13.00	3.25	4.25	1.75	2.25	do	
.....	.....	do	.....	1.13	2.25	3.25	14.00	3.25	4.00	2.00	2.25	do	
1014	.....	Republican River, Kans.	♀	.....	.....	3.00	11.00	3.00	3.75	.....	.....	do	
1014	.....	do	♂	.....	.....	1.00	11.50	3.25	4.50	1.65	2.40	do	
1905	.....	do	♀	.....	.....	2.13	11.00	2.75	3.25	.....	.....	do	
9727	548	Cheyenne, Wyo. Ter.	♂	1.49	2.33	2.75	11.40	4.00	5.10	1.85	2.45	do	
9728	550	do	♂	1.48	2.50	2.88	12.20	3.05	3.80	1.95	2.45	do	
9730	1213	do	♂	1.35	2.25	2.87	11.75	3.25	4.00	1.55	2.45	do	
9731	1214	do	♀	1.35	2.40	2.70	11.75	3.10	4.00	1.60	2.40	do	
9732	1073	Garden of the Gods, Colo.	.....	1.30	2.43	2.73	10.55	3.30	3.45	1.45	2.28	do	
9719	417	Fort Hays, Kans.	.....	1.17	2.05	2.30	7.75	2.00	2.55	1.04	1.96	do	
9720	508	do	♂	1.50	2.40	2.65	11.75	3.65	3.65	1.70	2.25	do	
9721	509	do	♀	1.45	2.45	2.55	12.25	2.90	3.75	1.83	2.27	do	
9722	510	do	♂	1.50	2.40	2.65	12.40	3.00	3.00	1.80	2.30	do	
9723	511	do	♀	1.23	2.20	2.40	10.80	2.60	3.70	1.70	2.25	do	
9724	512	do	♂	1.50	2.25	2.60	11.25	3.55	4.35	1.85	2.25	do	
9725	513	do	♂	1.30	2.00	2.35	9.00	2.75	3.35	1.60	2.07	do	
9726	514	do	♂	1.25	2.20	2.35	9.40	2.30	3.10	1.65	2.30	do	

<sup>a</sup> Measurements all taken by collectors in the field from fresh specimens.

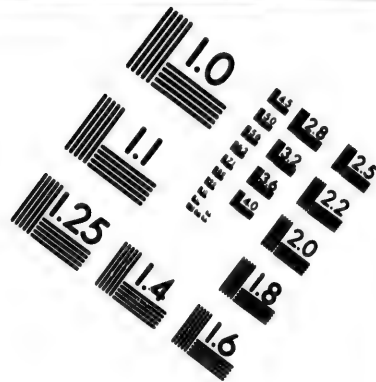
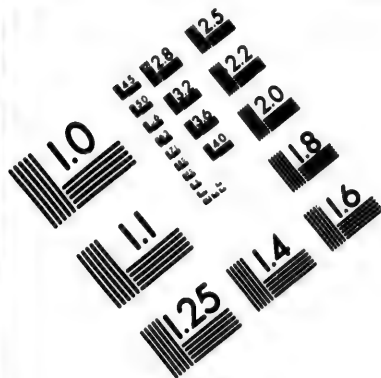
TABLE CXXVIII.—Measurements of nineteen skulls of CYNOMYS LUDOVICIANUS.

Catalogue number.	Locality.	Sex.	Total length.	Greatest width.	Distance between orbits.	Nasal bones, length.	Nasal bones, width behind.	Nasal bones, width before.	Upper incisors from front to molars.	Upper incisors from front to hinder margin of palate.	Upper incisors, height.	Upper incisors, width between external edges.	Upper molars, length taken together.	Lower jaw, length.	Lower jaw, height.
8110	Upper Missouri.....	♂	2.42	1.75	0.55	0.70	0.34	.....	0.67	1.35	.....	.....	.....	1.07	0.93
8150	do.....	♂	2.60	1.88	0.63	0.90	.....	.....	0.75	1.41	.....	.....	.....	1.60	0.84
8304	do.....	♂	2.45	1.75	0.55	0.85	0.24	.....	0.63	1.38	.....	.....	.....	1.40	0.87
854	Fort Pierre.....	♂	2.45	1.70	0.60	0.90	.....	.....	0.64	1.38	.....	.....	.....	1.10	0.84
1708	do.....	♂	2.47	1.10	0.77	0.90	0.34	0.50	0.67	1.40	0.43	0.95	0.90	1.03	0.95
3206	Platte River.....	♂	2.47	1.10	0.70	0.90	0.37	.....	0.70	1.42	.....	.....	.....	1.55	0.85
4363	Deer Creek.....	♂	2.35	1.70	.....	0.90	0.90	.....	0.61	1.30	.....	.....	.....	1.50	0.85
4365	do.....	♂	2.33	1.70	0.53	0.72	.....	.....	0.70	1.35	.....	.....	.....	1.60	0.95
3301	Pole Creek.....	♀	2.45	1.75	.....	0.98	0.96	.....	0.73	1.40	.....	.....	.....	1.60	0.95
3302	do.....	♂	2.46	1.78	0.60	0.85	0.25	.....	0.73	1.37	.....	.....	.....	1.62	0.87
3303	do.....	♂	2.50	1.10	0.63	0.70	0.35	.....	0.74	1.44	.....	.....	.....	1.67	0.94
3307	do.....	♂	2.60	1.85	0.10	0.97	0.27	0.30	0.74	1.41	0.43	0.95	0.63	1.60	0.87
3308	do.....	♀	2.50	1.75	0.62	0.97	0.25	0.48	0.70	1.37	0.50	0.95	0.65	1.65	0.90
3309	do.....	♀	2.43	1.73	0.55	0.90	0.24	0.59	0.67	1.40	0.48	0.95	0.60	1.75	0.17
1349	Fort Kearney.....	♂	2.10	1.00	0.47	0.95	0.24	0.50	0.73	1.30	0.90	0.25	0.09	1.63	0.90
1350	do.....	♂	2.50	1.75	0.55	0.97	0.25	0.48	0.70	1.40	0.50	0.95	0.65	1.75	0.17
1144	Limpco Mountain, Tex.....	♂	2.30	.....	0.00	0.65	0.27	.....	0.71	1.50	.....	.....	.....	1.53	0.98
1098	Presidio del Norte, Tex.....	♂	2.40	1.68	0.54	0.85	0.25	.....	0.65	1.35	.....	.....	.....	1.75	0.97
1156	Jornado del Muerto, N. M.....	♂	2.57	1.65	0.48	0.95	0.16	.....	0.73	1.50	.....	.....	.....	1.75	0.97

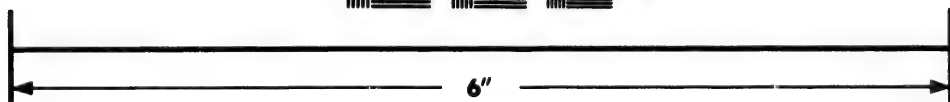
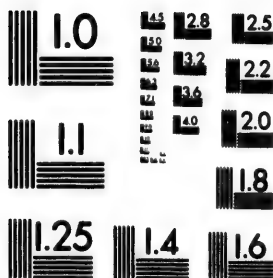
TABLE CXXIX.—List of specimens examined of CYNOMYS LUDOVICIANUS.

Catalogue number of skin.	Corresponding number of skull	Original number.	Sex.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
11934	.....	4197	♂	Near mouth Milk River	July 3, 1874	A. Campbell.....	Dr. E. Cones.....	Skin.
810	.....	.....	.....	Milk River	.....	L. I. Stevens.....	Dr. George Buckley.....	do.
1589	.....	.....	.....	Upper Missouri	.....	W. F. Reynolds.....	Dr. F. V. Hayden.....	do.
1590	.....	.....	.....	do	.....	do	do	do.
1530	.....	.....	.....	do	.....	do	do	do.
1531	.....	.....	.....	do	.....	do	do	do.
1532	.....	.....	.....	do	.....	do	do	do.
1533	.....	.....	.....	do	.....	do	do	do.
1534	.....	.....	.....	do	.....	do	do	do.
1535	.....	.....	.....	do	.....	do	do	do.
1536	.....	.....	.....	do	.....	do	do	do.
1537	.....	.....	.....	do	.....	do	do	do.
1538	.....	.....	.....	do	.....	do	do	do.
1539	.....	.....	.....	do	.....	do	do	do.
1540	.....	.....	.....	do	.....	do	do	do.
1541	.....	.....	.....	do	.....	do	do	do.
1542	.....	.....	.....	do	.....	do	do	do.
1543	.....	.....	.....	do	.....	do	do	do.
1544	.....	.....	.....	do	.....	do	do	do.





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TABLE CXXIX.—List of specimens examined of *CYNOMYS LUDOVICIANUS*—Continued.

Catalogue number of skin.	Corresponding number of skull.	Original number.	Sex.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
1543				Upper Missouri		W. F. Haystack	Dr. F. V. Hayden	Skin.
1546				do		do	do	do
	2149			do		do	do	Skull.
	2150			do		do	do	do
	2151			do		do	do	do
190				do		Dr. J. Evans	Dr. J. Evans	Skin.
10619				Camp Thorne, Yellowstone River.	July 30, 1873	Gen. D. M. Stanley	J. A. Allen	do
10613		945		Pompey's Pillar, Yellowstone River.	Aug. 15, 1873	do	do	do
10014		946		do		do	do	do
10615		501		do	July 30, 1873	do	do	do
1815			♀	Yellowstone River.	Aug. 10, 1858	Capt. W. F. Reynolds	Dr. F. V. Hayden	do
1816				do	Aug. 10, 1858	do	do	do
515				Fort Pierre, Dak.		T. Culbertson	T. Culbertson	do
778				do		Dr. J. Evans	Dr. J. Evans	do
806				do		do	do	do
	831			do		do	do	Skull.
647	1798			do		Dr. F. V. Hayden	Dr. F. V. Hayden	Skin and skull.
3380				Platte River		do	do	Skin.
3391				do		do	do	do
3378				do		do	do	do
3394				do		do	do	do
3395				do		do	do	do
3396				do		do	do	do
3377				do		do	do	do
3398				do		do	do	do
3399				do		do	do	do
3403				do		do	do	do
	4771			do		do	do	Skull.
3631	3301		♂	do	July 6, 1857	Lieut. F. T. Bryan	W. S. Wood	Skin and skull.
409		3		Fort Laramie		Capt. A. W. Whipple	Dr. C. B. R. Kemper	Skin.
3099	3090	430	♂	Platte River	July 6, 1857	Lieut. F. T. Bryan	W. S. Wood	Skin and skull.
0659				Camp Carling, W. T.		Dr. F. V. Hayden	H. D. Schmidt	Skin.
9653				do		do	do	do
9711				do		do	do	do
1400	2480			Fort Randall, Dak.	Oct. 30, 1879	do	Dr. F. V. Hayden	Skin and skull.
1698	2581			do		do	do	do
1409	2502			do		do	do	do
1411	2504			do		do	do	do
1819	2505			do		do	do	do
1813	2506			do		do	do	do
1814	2507			do		do	do	do
1807	2508			do		do	do	do
1401				do		do	do	Skin.
1402				do		do	do	do
1803				do		do	do	do
1404				do		do	do	do
1405				do		do	do	do
1806				do		do	do	do
1815				do		do	do	do
1816				do		do	do	do

TABLE CXXII.—List of specimens examined of CYNOMYS LUDOVICIANUS—Continued.

Catalogue number of skin.	Corresponding number of skull.	Original number.	Sex.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
1817	.....	.....	.....	Fort Randall, Dak	.....	Dr. F. V. Hayden	Dr. F. V. Hayden	Skin.
1818	.....	.....	.....	do	.....	do	do	do
1819	.....	.....	.....	do	.....	do	do	do
1880	.....	.....	.....	do	.....	do	do	do
10010	.....	.....	.....	Wyoming Territory	.....	do	do	Skull.
10018	.....	.....	.....	do	.....	do	do	do
10043	.....	.....	.....	do	.....	do	do	do
10017	.....	.....	.....	do	.....	do	do	do
9483	13215	.....	.....	Upper Missouri	.....	do	do	Skin and skull.
9496	13316	.....	.....	do	.....	do	do	do
9497	13317	.....	.....	do	.....	do	do	do
9499	13318	.....	.....	do	.....	do	do	do
9470	13319	.....	.....	do	.....	do	do	do
9471	13320	.....	.....	do	.....	do	do	do
9473	13321	.....	.....	do	.....	do	do	do
9474	13321	.....	.....	do	.....	do	do	do
9499	13323	.....	.....	do	.....	do	do	do
3001	3007	♂	♂	Polo Creek	Aug. 11, 1857	Lieut. F. T. Bryan	W. S. Wood	do
3007	3004	.....	.....	do	Aug. 11, 1857	do	do	do
3003	3006	♀	♀	do	Aug. 11, 1857	do	do	do
3001	3002	.....	.....	do	Aug. 11, 1857	do	do	do
3004	3000	♀	♀	do	Aug. 11, 1857	do	do	do
3000	3008	.....	.....	do	Aug. 11, 1857	do	do	Skull.
3000	3000	.....	.....	do	Aug. 11, 1857	do	do	Skin and skull.
4083	.....	.....	.....	Deer Creek	.....	Dr. F. V. Hayden	Dr. F. V. Hayden	Skull.
4084	.....	.....	.....	do	.....	do	do	do
4085	.....	.....	.....	do	.....	do	do	do
1049	.....	♂	♂	Fort Kearney, Kans.	.....	Dr. W. A. Hammond	Dr. W. A. Hammond	do
1000	.....	.....	.....	do	.....	do	do	do
*7797	190	♂	♂	Chayenne, Wyo. Ter.	Aug. —, 1871	Rocky Mountain Expedition.	Allen, Bennett, and Blinn.	Skin and skull.
*7798	200	♂	♂	do	Aug. —, 1871	do	do	Skin.
*7799	1919	.....	.....	do	Aug. —, 1871	do	do	do
*7790	1923	♂	♂	do	Aug. —, 1871	do	do	do
*7731	190	1 <sup>st</sup> ♀	♀	do	Aug. —, 1871	do	do	Skin and skull.
*7730	1073	.....	.....	do	Aug. —, 1871	do	do	Skin.
*7719	417	.....	.....	Fort Hays, Kans.	June 3, 1871	do	do	do
*7720	506	♂	♂	do	June 13, 1871	do	do	do
*7721	509	♀	♀	do	June 13, 1871	do	do	do
*7723	510	♂	♂	do	June 13, 1871	do	do	do
*7722	511	♀	♀	do	June 13, 1871	do	do	do
*7724	510	♂	♂	do	June 13, 1871	do	do	do
*7725	513	♀	♀	do	June 13, 1871	do	do	do
*7726	514	♀	♀	do	June 13, 1871	do	do	do
6304	.....	.....	.....	Denver, Colo.	.....	Dr. E. Palmer	Dr. E. Palmer	Skull.
11493	.....	.....	.....	Colorado	.....	Dr. F. V. Hayden	J. H. Batty	Skin.
9556	.....	.....	.....	do	.....	do	do	do
9537	.....	.....	.....	Soda Springs, Colo. Ter.	Aug. 16, 1860	do	J. Havemann	do
9550	.....	.....	.....	do	.....	do	do	do
9550	.....	.....	.....	do	.....	do	do	do
9550	.....	.....	.....	do	.....	do	do	do
9550	.....	.....	.....	do	.....	do	do	do

\* In Museum of Comparative Zoology, Cambridge, Mass.

TABLE CXXIX.—List of specimens examined of *CYNOMYS LUDOVICIANUS*—Continued.

Catalogue number of skin.	Corresponding number of skull.	Original number.	Sex.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimens.
9070				Don Carlos, Colo.	Aug. 10, 1889	Dr. F. V. Hayden	J. Stevenson	Skin.
500				Llano Estacado		Capt. John Pope	Dr. McKee	do.
3496				Fort Defiance, N. Mex.				do.
1717				Pecos, N. Mex.	Apr. 24, 1896	Capt. John Pope	Dr. McKee	do.
1905		943	♀	Republican Fork	Oct. 16, 1896	Lieut. F. T. Bryan	W. B. Wood	do.
	1080			Presidio del Norte		Maj. W. H. Emory	J. H. Clark	Skull.
161	1144			Lincoln Mts., Tex.		do.	do.	Skin and skull.
496	1635			San Antonio, Tex.		do.	do.	do.
329	1958			New Mexico		Capt. A. W. Whipple	Dr. C. B. R. Kennery	do.
1054				Devil's River, Tex.		do.	do.	Skin.
354				Pecos River, Tex.		do.	do.	do.
1039				Arkansas		Capt. L. Stigraevs	Dr. E. W. Woodhouse	do.
	1160			Red River, Ark.		Dr. B. F. Shumard	Dr. B. F. Shumard	Skull.
1651				Fort Chadbourne, Tex.		Dr. E. Swift	Dr. E. Swift	Skin.
7770			♂	Fort Larned, Ind. Ter.	May 31, 1864	Dr. E. Coues	Dr. E. Coues	do.

## CYNOMYS COLUMBIANUS (Ord) Allen.

## Western Barking Squirrel; Western "Prairie Dog".

- Arctomys columbianus* "Ord, Guthrie's Geog. 91 Am. ed. ii, 1815, 298, 303" (= "Burrowing Squirrel", Lewis and Clarke).—ALLEN, Proc. West. Soc. Nat. Hist. xvi, 1874, 904; Bull. Essex Inst. vi, 1874, 57, 60 (Colorado).—COUES & YARROW, Wheeler's Expl. and Surv. W. of 100th Merid. v, Zool. 1875, 132 (Middle Utah).
- Arctomys brachyura* RAVINUSQUE, Am. Month. Mag. ii, 1817, 45 (= "Burrowing Squirrel", Lewis and Clarke).—DERMARKER, Mam. 1893, 329 (from Ravinusque).
- Arctomys brachyura* HARRIS, Fauna Amer. 1835, 304 (= "Burrowing Squirrel", Lewis and Clarke).—FISCHER, Synop. Mam. 1839, 345 (from Harris).—RICHARDSON, Zool. Beechey's Voy. 1839, 7 (from the same).—WAGNER, Suppl. Schreber's Säuget. ii, 1843, 361 (from the same).—SCHINZ, Syn. Mam. ii, 1845, 62 (from the same).
- Arctomys lewis* AUDUBON & BACHMAN, Quad. N. Am. iii, 1853, 32, pl. cvii (from specimen in Mus. Zool. Soc. Lond. from "Columbia River"). See also BAIRD, Mam. N. Amer. 1857, 347.
- Cynomys gunnisoni* BAIRD, Proc. Acad. Nat. Sci. Phila. 1855, 334; Mam. N. Amer. 1857, 335, pl. iv, fig. 2, animal; pl. xvii, fig. 4, skull.—COUES, Amer. Nat. i, 1867, 369; Proc. Acad. Nat. Sci. Phila. 1867, 135 (Arizona).—STEVENSON, Hayden's Rep. U. S. Geol. Surv. Wyo. 1871, 402.
- Burrowing Squirrel*, LEWIS & CLARKE, Travels, 1st Am. ed. ii, 1815, 173.
- Lewis's Marmot*, AUDUBON & BACHMAN, l. c.
- Short-tailed Prairie Dog*, BAIRD, Mam. N. Amer. 1857, 335.

**SPECIFIC CHAR.**—Length to base of tail about 10.25, ranging from 9.50 to 11.50; of tail to end of vertebrae about 2.00 (1.70 to 2.25); to end of hairs 2.00 to 2.50. Above, dark yellowish-brown, sometimes inclining to reddish, varied with black; beneath, yellowish-white, varying to pale yellowish-brown. Tail very short, flattened, generally wholly pure white (sometimes yellowish-white) for the terminal half, the basal portion being above like the

back and below like the ventral surface. Ears and general proportions as in *C. ludovicianus*, except that the tail is shorter.

Different specimens, even from the same locality, vary considerably in respect to color, the dorsal surface being in some pale reddish, as strong as in very pale specimens of *C. ludovicianus*, and in others with only a slight tinge of rufous. The proportion of black hairs also varies greatly, being sometimes so abundant as to give a decidedly dusky shade to the whole dorsal surface, with the head quite blackish and the tail strongly mixed with black, with a narrow, partly concealed, subterminal bar of dusky within the terminal white area. The extremes of variation in color thus give rise to widely diverse phases, but a large series presents every possible stage of intergradation between these extremes. The lower surface varies from pale yellowish-white to bright yellowish-brown or tawny.

Although occasionally specimens of *C. columbianus* are met with that present almost exactly the shade of coloration sometimes seen in *C. ludovicianus*, as a rule the two species are readily distinguishable by coloration alone.

In *C. columbianus*, the general color above is yellowish-brown rather than reddish-brown, with a greater admixture of blackish. *C. columbianus* also averages considerably smaller (nearly two inches shorter in head and body length), and has relatively a very much shorter and differently colored tail, it being only about one-half as long as in *C. ludovicianus*.

As already stated, this species, like the preceding, was first discovered by Lewis and Clarke, and was first named by Ord, in 1815, from the description of it given in the "Biddle-Allen" narrative of their journey. Rafinesque, two years later, founded his genus *Anisonyx* on a misinterpretation of Lewis and Clarke's description, and renamed the species *Anisonyx brachyura*. Ord's prior name was either overlooked or ignored by subsequent authors (Harlan, Richardson, and several foreign compilers), who, however, while adopting Rafinesque's specific appellation, referred the species to *Arctomys*. Their accounts are either simply a quotation of, or a compilation from, Lewis and Clarke's description. Audubon and Bachman, in 1853, renamed the species *Arctomys lewisi*, basing their description on a specimen in the Museum of the Zoölogical Society of London labelled "*Arctomys brachyura?* Harlan", and said to have come from the Plains of the Columbia. Audubon and Bachman found, as they thought, sufficient discrepancies between the specimen described by them and Lewis and Clarke's description to warrant them in

considering the latter as probably referable "to some species of *Spermophile*—probably *Spermophilus townsendi*". They were led to this belief by finding that Lewis and Clarke "refer to an animal whose whole contour resembles that of the Squirrel, the thumbs being remarkably short and equipped with blunt nails, and the hair of the tail thickly inserted on the sides only, which gives it a flat appearance, whereas the animal of this article [*Arctomys lewisii*] does not resemble a squirrel in its whole contour; its thumbs, instead of being remarkably short and equipped with blunt nails, have long nails nearly the length of those on the other toes, and the tail, instead of being flat with the hairs inserted on the sides, is quite round. It differs also so widely in several other particulars that we deem it unnecessary to institute a more minute comparison."\* Audubon and Bachman were, however, misled in regard to the character of the tail, which is not "quite round", but has "a flat appearance, and a long oval form", as described by Lewis and Clarke. They have, in other particulars, evidently placed a forced construction upon Lewis and Clarke's description.

As the whole synonymy of the species turns upon Lewis and Clarke's description, I quote it in full. "There is also a species of squirrel", say these authors, "evidently distinct [from those they had just described], which we have denominated the burrowing squirrel. He inhabits these plains [of the Columbia], and somewhat resembles those found on the Missouri;† he measures one foot and five inches in length, of which the tail comprises two and a half inches only: the neck and legs are short; the ears are likewise short, obtusely pointed, and lie close to the head, and the aperture larger than will generally be found among burrowing animals. The eyes are of a moderate size, the pupil black, and the iris of a dark sooty brown: the whiskers are full, long, and black: the teeth, and, indeed, the whole contour, resemble those of the squirrel: each foot has five toes; the two inner ones of the fore feet [meaning, evidently, the inner toe of each foot] are remarkably short, and are equipped with blunt nails: the remaining toes on the front feet are long, black, slightly curved, and sharply pointed: the hair of the tail is thickly inserted on the sides only, which gives it a flat appearance, and a long oval form: the tips of the hair forming the outer edges of the tail are white, the other extremity of a fox red: the under part of the tail resembles an iron

\* Quad. N. Amer. iii, p. 34.

† Their "Barking Squirrel", = *Cynomys ludovicianus*.

gray; the upper is of a reddish brown: the lower part of the jaws, the under part of the neck, legs and feet, from the body and belly downwards, are of a light brick-red: the nose and eyes are of a darker shade, of the same colour: the upper part of the head, neck, and body are of a curious brown gray, with a slight tinge of brick red: the longer hairs of these parts are of a reddish white color at their extremities, and falling together give this animal a speckled appearance. These animals form in large companies, like those on the Missouri, occupying with their burrows sometimes two hundred acres of land: the burrows are separate, and each possesses, perhaps, ten or twelve of these inhabitants. There is a little mound in front of the hole, formed of the earth thrown out of the burrow, and frequently there are three or four distinct holes, forming one burrow, with these entrances around the base of these little mounds. These mounds, sometimes about two feet in height and four in diameter, are occupied as watch-towers by the inhabitants of these little communities. The squirrels, one or more, are irregularly distributed on the tract they thus occupy, at the distance of ten, twenty, or sometimes from thirty to forty yards. When any one approaches, they make a shrill whistling sound, somewhat resembling *tweet, tweet, tweet*, the signal for their party to take the alarm, and to retire into their intrenchments. They feed on the roots of grass, &c.\*

In this account, there is nothing respecting the external features of the animal that is not strictly applicable to the present species, as illustrated by the large *skate* of specimens before me, though the color of neither the dorsal or ventral surface is quite so red as one would naturally infer from their description of it.† Many specimens are, however, decidedly reddish above and rusty-yellow below, which is the "light brick red" of the above account. There is certainly a "slight tinge of brick red" in the coloration of the upper surface. The description of the feet, so far as it goes, is strictly correct, the inner toe of the fore feet being "remarkably short" as compared with the other toes, and equipped with a "blunt nail", not a "long nail, nearly the length of those of the other toes", as stated by Audubon and Bachman, but still much longer than in the true *Spermophiles* and *Squirrels*, as is also the

\* Lewis and Clarke's Travels, 1st Amer. ed. vol. ii, pp. 173, 174.

† In respect to their account of the color of this animal, it may be noted that they describe their "Barking Squirrel" of the plains of the Upper Missouri as being of "a uniform bright brick-red and gray", the former predominating, with the lower parts lighter, indicating that the redness is much stronger in the Missouri animal, as it really is.



thumb. Lewis and Clarke's account of their mode of living in communities, of the character of their burrows, and of their habits, is truthful in all its details, as I can affirm from personal observation. On the other hand, there is nothing in the account of the external characters of these animals that very strongly recalls *Spermophilus townsendi*, while the size and the relative length of the tail at once show the impossibility of referring the "Burrowing Squirrel" of Lewis and Clarke to the *Spermophilus townsendi* of Audubon and Bachman.

In 1855, Professor Baird gave to this species the name *gunnisoni*, based on a single specimen collected by Mr. Kreutzfeldt, in the Coosachitope Pass, Rocky Mountains. In 1857, in redescribing the species in his Mammals of North America, he very doubtfully referred the Burrowing Squirrel of Lewis and Clarke, together with the systematic names based thereon by Ord and Rafinesque, to his *C. gunnisoni*, but noted some discrepancies between Lewis and Clarke's description and his specimens, of which he had at this time three,—the original one from Coosachitope Pass and one each from Pole Creek and Medicine Bow Creek. As the two latter differ from the first, he thought it possible that they represented two species, while the *Arctomys levisi* of Audubon and Bachman he deemed might form a third, all different from *C. ludovicianus*. Later, he thought it quite possible that the *Arctomys levisi* might prove to be the same as Lewis and Clarke's animal, explaining how some of the discrepancies between the accounts given by Lewis and Clarke and by Audubon and Bachman might be presumably explained. On the whole, he was inclined to consider "the *Arctomys levisi* rather as a *Cynomys* [than an *Arctomys*], and quite possibly the same with the Burrowing Squirrel of Lewis and Clarke, called *Arctomys columbianus* by Ord, and *Anisomys brachyura* by Rafinesque".

The large number of specimens since received renders unquestionable the reference of all these names to the Burrowing Squirrel of Lewis and Clarke, for which the name *columbianus* of Ord becomes the only tenable specific designation.

This species, as already stated, was first met with on the Plains of the Columbia by Lewis and Clarke, in 1806. As shown by the subjoined list of specimens, it has been since met with on the Ogden River and about Fort Bridger in Northern Utah, and as far eastward as the Medicine Bow and Wind River Mountains. Further southward, it ranges throughout the Parks

of Central Colorado, and has been met with at Fort Massachusetts, New Mexico, near the sources of the Arkansas (Cooachitope Pass), and the San Francisco Mountains in Arizona. It has also been reported by Drs. Coues and Yarrow from Panquitch Lake and Dog Valley, Middle Utah. I have reason to believe that it occurs at irregular intervals throughout the Great Basin to the Sierra Nevada Mountains. I have seen no reference to its occurrence to the eastward of the eastern foot-hills of the Rocky Mountains. I found it, in 1871, in South Park, at an elevation of about 10,000 feet, and thence eastward nearly to the edge of the Plains, where it is immediately replaced by *C. ludovicianus*. In Colorado, I found the last named common on the plains at the very base of the foot-hills from Colorado City to Denver, and *C. columbianus* common at all favorable points from South Park eastward to the base of Pike's Peak. It differs quite notably in habits and in the character of its burrows from the species of the Plains, its burrows being unprotected by a raised funnel-shaped entrance, so characteristic of those of the latter. The best account of its habits thus far published is contained in the short notice given by Lewis and Clarke, already quoted.

TABLE CXXX.—Measurements of eighteen specimens of CYNOMYS COLUMBIANUS.\*

Catalogue number.	Original number.	Locality.	Sex.	From tip of nose to—					Tail to end of—		Length of—		Nature of specimen.
				Eye.	Ear.	Occiput.	Tail.		Vertebra.	Hind.	Fore foot.	Hind foot.	
2706	261	South Park, Colo.	♂	1.30	2.00	2.45	9.75	9.00	2.45	1.00	2.12	2.18	Fresh.
.....	262	do	.....	1.30	2.04	2.45	10.00	1.85	2.25	1.27	2.20	.....	do.
2707	264	do	.....	1.15	2.00	2.45	9.70	2.10	2.55	1.40	2.25	.....	do.
.....	265	do	.....	1.15	2.04	2.35	9.65	2.15	2.50	1.60	2.15	.....	do.
.....	267	do	.....	1.30	2.30	2.35	9.50	1.70	2.00	1.70	2.00	.....	do.
2708	268	do	.....	1.30	2.30	2.50	9.65	2.05	2.45	1.67	2.25	.....	do.
2709	269	do	.....	1.40	2.32	2.60	11.50	1.50	2.30	1.78	2.30	.....	do.
2710	1011	El Paso County, Colo.	♂	1.17	1.95	2.35	9.40	1.60	1.95	1.45	2.05	.....	do.
2705	1012	do	♀	1.35	2.25	2.25	10.15	2.25	2.85	1.60	2.15	.....	do.
2711	1013	do	♂	1.27	2.15	2.50	10.50	1.95	2.20	1.23	2.15	.....	do.
2712	1026	do	.....	1.30	2.05	2.40	10.00	2.00	2.50	1.60	2.30	.....	do.
2713	1027	do	.....	1.50	1.85	2.15	9.25	1.75	2.30	1.43	2.10	.....	do.
2714	1028	do	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	do.
2715	1029	do	.....	1.30	2.08	2.45	9.50	1.90	2.40	1.75	2.30	.....	do.
2716	1030	do	.....	1.50	2.20	2.50	10.90	2.00	2.50	1.55	2.25	.....	do.
2717	1031	do	.....	1.25	2.15	2.45	10.70	1.90	2.30	1.55	2.10	.....	do.
2704	1032	do	♀	1.30	2.25	2.55	11.50	1.60	2.10	1.65	2.30	.....	do.
2718	1033	do	.....	1.50	2.12	2.50	10.50	1.90	2.40	1.70	2.05	.....	do.

\* Measurements all taken by myself in the field from specimens in the flesh.

TABLE CXXXI.—Measurements of ten skulls of *CYNOMYS COLUMBIANUS*.

Catalogue number.	Locality.	Total length.	Greatest width.	Distance between orbits.	Nasal bones, length.	Nasal bones, width behind.	Nasal bones, width before.	Upper incisors from front to meatus.	Upper incisors from front to alveolar margin of jawline.	Upper incisors, height.	Upper incisors, width between external edges.	Upper molars, length taken together.	Lower jaw, length.	Lower jaw, height.
3054	Fort Massachusetts, N. Mex. ....	2.94	1.08	0.50	0.75	0.93	0.40	0.70	1.23	0.40	0.15	0.85	1.45	0.75
1636	Cochetope Pass .....	1.55	0.57	0.29	0.28	0.40	0.28	1.25	0.38	0.25	0.09	1.00	1.00	0.70
6550	San Francisco Mountains, Ariz. ....	2.15	1.50	.....	0.29	0.33	0.36	0.29	1.50	0.54	0.28	0.33	1.00	0.70
194	El Paso County, Colo. ....	2.35	1.65	0.28	.....	0.33	.....	0.63	1.27	.....	.....	0.00	1.00	0.70
185	do .....	2.30	1.67	0.50	0.83	0.95	0.38	0.65	1.25	.....	.....	0.50	1.00	0.75
198	do .....	2.35	1.70	0.55	0.86	0.95	0.40	0.67	1.27	.....	.....	0.50	1.28	0.80
197	do .....	2.40	1.70	0.54	0.86	0.94	0.40	0.67	1.26	.....	.....	0.54	1.04	0.80
198	do .....	2.98	1.63	0.50	0.70	0.97	0.40	0.63	1.84	.....	.....	0.56	1.06	0.80
199	do .....	2.33	1.75	0.55	0.78	0.95	0.40	0.67	1.27	.....	.....	0.57	1.00	0.80
309	do .....	2.45	1.85	0.57	0.90	0.95	0.40	0.70	1.31	.....	.....	0.60	1.07	0.90

TABLE CXXXII.—List of specimens examined of *CYNOMYS COLUMBIANUS*.

Catalogue-numbered skin.	Corresponding number of skull.	Original number.	Sex.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
9718	256	.....	.....	Big Sandy, Wyo. T. ....	Sept. 7, 1870	Dr. F. V. Hayden.	H. D. Schmidt.	Skin.
9713	404	.....	.....	Ayden River, U. T. ....	Sept. 8, 1870	do .....	do .....	do.
9714	518	.....	.....	Fort Bridger, U. T. ....	Sept. 27, 1870	do .....	do .....	do.
9715	549	.....	.....	do .....	Sept. 27, 1870	do .....	do .....	do.
9716	579	.....	.....	do .....	Sept. 27, 1870	do .....	do .....	do.
9717	571	.....	.....	do .....	Sept. 27, 1870	do .....	do .....	do.
9718	573	.....	.....	do .....	Sept. 27, 1870	do .....	do .....	do.
9719	574	.....	.....	do .....	Sept. 27, 1870	do .....	do .....	do.
9720	575	.....	.....	do .....	Sept. 30, 1870	do .....	do .....	do.
9751	583	.....	.....	do .....	Sept. 30, 1870	do .....	do .....	do.
5843	.....	.....	.....	do .....	.....	C. Drexler .....	C. Drexler .....	do.
4390	.....	.....	.....	Wind River Mountains ..	May 18, 1880	Dr. F. V. Hayden.	Dr. F. V. Hayden.	do.
.....	54	.....	.....	do .....	.....	do .....	do .....	do.
4391	.....	.....	.....	New Mexico .....	.....	Dr. W. W. Anderson.	Dr. W. W. Anderson.	do.
5261	1606	.....	.....	Cochetope Pass, E. Mts. ....	.....	Lt. E. G. Beckwith.	C. Kraitsfeld.	Skin and skull.
11903	.....	.....	.....	Pole Creek .....	July 33, 1859	Lt. F. T. Bryan.	W. S. Wood.	Skin.
3810	3703	.....	♂	Near Medicine Bow Mts. ....	July 33, 1857	do .....	do .....	Skin and skull.
3089	3062	.....	.....	do .....	July 33, 1857	do .....	do .....	do.
3088	.....	.....	.....	do .....	July 37, 1857	do .....	do .....	Skin.
3504	.....	.....	.....	Fort Laramie .....	Aug. 15, 1858	C. Drexler .....	C. Drexler .....	do.
4898	.....	.....	.....	Red Buttes of Platte .....	Oct. 30, 1859	Dr. F. V. Hayden.	Dr. F. V. Hayden.	do.
9728	594	.....	.....	Colorado .....	.....	do .....	J. H. Batty.	do.
11447	.....	.....	.....	do .....	.....	do .....	do .....	do.
11448	.....	.....	.....	do .....	.....	do .....	do .....	do.
11449	.....	.....	.....	do .....	.....	do .....	do .....	do.
11450	.....	.....	.....	do .....	.....	do .....	do .....	do.
11451	.....	.....	.....	do .....	.....	do .....	do .....	do.

\* Original type of "*C. gunnisoni*."† "*C. gunnisoni*."

TABLE CXXXII.—List of specimens examined of *CYNOMYS COLUMBIANUS*—Continued.

Catalogue number of skin.	Corresponding number of skull.	Original number.	Sex.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
11430				Colorado.....		Dr. F. V. Hayden.	J. H. Bailey.....	Skin.
11433				do.....		do.....	do.....	do.
11434				do.....		do.....	do.....	do.
11435				do.....		do.....	do.....	do.
11436				do.....		do.....	do.....	do.
11437				do.....		do.....	do.....	do.
11438				do.....		do.....	do.....	do.
11604	806			Twin Lakes, Colo.....	Aug., 1873	La. G. M. Wheeler.	Dr. J. T. Rothrock.	Alcohol.
11605	170			do.....	Aug., 1873	do.....	do.....	Skin.
11606				do.....	Aug., 1873	do.....	do.....	do.
4776				Fort Buchanan.....	July 4, 1873	do.....	do.....	do.
5706	961	♂		South Park, Colo.....	July, 1871	Rocky Mt. Exped.	Allen, Bennett, and Bliss.	Skin and skull.
	960			do.....	July, 1871	do.....	do.....	do.
5707	964			do.....	July, 1871	do.....	do.....	do.
	963			do.....	July, 1871	do.....	do.....	do.
	966			do.....	July, 1871	do.....	do.....	do.
5708	967			do.....	July, 1871	do.....	do.....	do.
5709	968			do.....	July, 1871	do.....	do.....	do.
5710	1011	♂		El Paso County, Colo.....	July, 1871	do.....	do.....	do.
5703	1012	♀		do.....	July, 1871	do.....	do.....	do.
5711	1013	♀		do.....	July, 1871	do.....	do.....	do.
5712	1026			do.....	July, 1871	do.....	do.....	do.
5713	1027			do.....	July, 1871	do.....	do.....	do.
5714	1028			do.....	July, 1871	do.....	do.....	do.
5715	1029			do.....	July, 1871	do.....	do.....	do.
5716	1030			do.....	July, 1871	do.....	do.....	do.
5717	1031			do.....	July, 1871	do.....	do.....	do.
5764	1032	♀		do.....	July, 1871	do.....	do.....	do.
5718	1033			do.....	July, 1871	do.....	do.....	do.
	3653			Fort Massachusetts, N. H.		La. F. T. Bryan	W. S. Wood	Skull.
3188				do.....		Dr. D. C. Peters	Dr. D. C. Peters	Skin.
6030	7189			San Francisco Mts., Ariz.		Dr. E. Coates	Dr. E. Coates	Skin and skull.

GENUS *ARCTOMYS* Schreber.*Mus LINNÆUS* (in part).*Glis* ERXLEBEN, Syst. N. g. Anim. 1777, 368 (in part).*Mus saporosus* PALLAS, Nov. Spec. Gliræ, 1778, 74 (excluding his *Mus citellus*).*Arctomys* SCHREBER, Säuget. iv. 1793\* [prior to 1788], 790 (in part; includes also *Spermophilus*).*Arctomys* F. CUVIER, Dents des Mam. 1805, 169, 254, pl. liv (based on "*Arctomys alpinus* Linn." and "*Arctomys campestris* Pall.".)

\* "Theil IV" of Schreber's Säugethiere bears the date "1793", which is probably the date of the completion of the part, and not of the publication of the earlier fasciculi. Gmelin quotes Schreber in his *Systema Naturæ*, which bears the date 1788, and credits Schreber with the genus *Arctomys*. On the other hand, Schreber first quotes Gmelin's work under *Hyrax*, near the end of Theil IV, and two hundred pages beyond *Arctomys*. The publication of *Arctomys* by Schreber must have been as early as 1788, and may have been several years prior to this date. The description of *Arctomys* occurs near the end of the first third of Theil IV. The date on the title page of Theil III is 1779.

† M. F. Cuvier says, at the end of his description of the dentition of *Arctomys*,—"Ces dents ont été décrites d'après la marmotte des Alpes, et d'après l'empêtre de Pallas." In his "Table méthodique des

GENERIC CHARs.—Skull with the dorsal outline nearly straight; frontal region flat or depressed; postorbitals triangular at base, with a long, spreading, decurved point; zygomatic arches moderately expanded, not widening and diverging posteriorly; grinding-teeth rather small, the transverse and antero-posterior diameters about equal, and the molar series very nearly parallel; occipital and interparietal crests well developed (in old age); ante-orbital foramina subtriangular, widest below, but not thrown outward. Size large; body thick-set, broad, depressed; cheek-pouches small; tail rather short, bushy, not flattened; ears small; nail of pollex broad, flat, or wanting; pelage with long coarse hairs and thick under fur. Coloration generally yellowish-gray, without either distinct spots or stripes.

The genus *Arctomys* differs from *Cynomys* in many quite important features. In *Arctomys*, the dorsal outline of the skull is straight, or nearly so, instead of highly arched, as in *Cynomys*; the zygomatic arches are relatively smaller, and reach their greatest expansion near the middle instead of at their posterior border; the grinding-teeth are small, in nearly parallel series, and differ widely from those of *Cynomys* in shape and in mode of insertion. In *Arctomys*, the molars are inserted nearly vertically, as in the true Squirrels; in *Cynomys*, their insertion is quite oblique. In *Arctomys*, the triturating surface of the crowns is nearly square, but the inner border is somewhat narrowed, so that the teeth of the same series touch each other by their crown surfaces for only two-thirds of their transverse breadth; in *Cynomys*, the transverse breadth of the crowns is twice that of the antero-posterior, and internally the teeth are so much narrowed that they abut closely for only half their transverse breadth, leaving internally deep openings between the teeth. In *Arctomys*, the palate is broad and scarcely narrower at the last molar than anteriorly, while in *Cynomys* the palate is rapidly and greatly narrowed posteriorly. Hence *Arctomys* differs very widely from *Cynomys* in respect to the size, form, and position of the molar teeth and the form of the bony palate. In all these points, *Arctomys* is more Sciurine than is even

ordres, genres et espèces qui sont nommées dans cet ouvrage [Dents des Mammifères], avec une synonymie latine", occurs the following:—

"54. Marmottes, *arctomys*. Gmel.

"Marmotte des Alpes, *Arctomys alpinus*. Linn.

"Marmotte du Canada, *Arctomys campestris*. Pall."

What he means by "*Arctomys campestris* Pall." is certainly not clear, since no original description of Pallas's *campestris* had at this date (1826) appeared, except Pallas's original account of his *Mus campestris*. Sabine's *Arctomys campestris* (1822) is *Arctomys monax*. If Cuvier had specimens of the "Marmotte du Canada", his "*Arctomys campestris* Pall." is doubtless also referable to *A. monax*.

*Spermophilus*, differing scarcely more from *Sciurus* than do the *Otospermophilus* forms of *Spermophilus*. On the other hand, it is in these features that *Cynomys* is highly specialized. The skull of *Arctomys*, viewed in its totality, differs from the *Sciurine* forms of *Spermophilus* mainly in its very much larger size, and in its much straighter dorsal outline. This, in part, results from the depression of the interorbital region, and in part from the great development of the occipital crests, naturally correlating with the large size and heavier form of the animal. The triturating surface of the molar teeth in *Arctomys* presents two deep transverse grooves, extending from the outer edge to the middle of the tooth, instead of three, as in *Cynomys*, agreeing in this respect with *Spermophilus*, *Tamias*, and *Sciurus*. The first upper premolar is relatively not larger than it usually is in *Spermophilus*, and is smaller, absolutely as well as relatively, than in *Cynomys*.

The genus *Arctomys* embraces the largest members of the *Sciuridæ*, and, excepting *Castor*, the largest of the existing North American Rodentia. The group is represented throughout the northern and middle portions of the northern hemisphere, and is not found elsewhere. In the present paper, three species are provisionally recognized as North American and as distinct from their nearest Old World allies.

## ARCTOMYS MONAX (Linn.) Schreber.

## Woodchuck.

- Mus monax* LINNÆUS, Syst. Nat. 10th ed. i, 1758, 60; 13th ed. i, 81 (based wholly on Edwards's description and figure of a specimen from Maryland).—PALLAS, Nov. Spec. Gilvæ, 1778 (in part only).—BODDERT, "Elench. Anim. i, 1784, 105."
- Glis monax* ERXLEBEN, Syst. Anim. 1777, 361 (in part only).
- Arctomys monax* SCHREBER, Säuget. iv, 737.—SHAW, Gen. Zool. ii, 1808, 117.—F. CUVIER, Dict. des Sci. Nat. xxix, 1823, 162.—WARDEN, Descrip. des États-Unis, v, 1820, 627.—DESMARET, Nouv. Dict. d'Hist. Nat. xix, 1818, 314; Mam. 1822, 328 (in part only).—SARINÉ, Trans. Linn. Soc. xiii, 1822, 582.—HARLAN, Faun. Amer. 1825, 158.—GODMAN, Amer. Nat. Hist. ii, 1836, 100.—I. GEOFFROY, Dict. Class. d'Hist. Nat. x, 1827, 186.—HAMILTON-SMITH, Griffith's Cuvier's An. K. 1827, 170 (with plate); v, 1827, 244.—RICHARDSON, Faun. Bor.-Amer. i, 1829, 153 (compiled, chiefly from Godman).—FISCHER, Synop. Mam. 1829, 342.—EMMONS, Quad. Mass. 1840, 64.—DE KAY, New York Zool. i, 1842, 64, pl. xxi, fig. 4.—THOMPSON, N. t. Hist. Vermont, 1843, 44.—WAGNER, Suppl. Schreber's Säuget. iii, 1843, 259 (in part).—SCHINZ, Syn. Mam. ii, 1846, 61.—AUDUBON & BACHMAN, Quad. N. Amer. i, 1849, 17, pl. ii.—GIEBEL, Säuget. 1855, 620 (in part only; includes all the American species).—KENNICOTT, Trans. Ill. State Agr. Soc. i, 1855, 170; U. S. Pat. Off. Rep. Agr. 1856 (1857), 82, pl. x.—BAIRD, Mam. N. Amer. 1857, 330, pl. xlix, fig. 1 (skull).—THOMAS, Trans. Ill. State Agr. Soc. iv, 1860, 657.—ROSS, Edinb. New Phil. Journ. xlii, 1861, 108; Canad. Nat. and Geol. 1861, 434; Nat. Hist. Rev. 1862, 274.—MAXIMILIAN, Arch. f. Naturgesch. 1861, 93.—ALLEN, Bull. Mus. Comp. Zool. i, 1869, 226 (Massachusetts); Proc. Boat. Soc. Nat. Hist. xiii, 1870, 190 (Iowa); xvi, 1874, 294.—COPE, Proc. Amer. Phil. Soc. Phila. xi, 1869, 173 (fossil bone-caves, Virginia).—GULPIN, Proc. and Trans. Nova Scotia Inst. Nat. Sci. ii, pt. iii, 1870, 16.—ADAMS, Field and Forest Rambles, 1873, 100, 296 (New Brunswick).

- Mus (Arctomys) monax* HALL, Can. Nat. and Geol. 1860, 302.  
*Glis canadensis* ERXLEBEN, Syst. Anim. 1777, 363 (in part only; = Quebec Marmot, Pennant + Quebec Marmot, Forster).  
*Mus empetra* PALLAS, Nov. Spec. Gliræ, 1778, 74 (= *Arctomys parryi* Richardson, excepting reference to Pennant's Quebec Marmot).—BODDERT. "Elench. Anim. i, 1784, 165."  
*Arctomys empetra* SAGINE, Trans. Linn. Soc. xiii, 1829, 654 (the description only; not the synonymy; not *Mus empetra* Pallas, nor the *Arctomys empetra* Schreber, Gmelin, and previous authors generally); † Franklin's Journ. 1823, 662.—HARLAN, Faun. Amer. 1825, 160 (in small part only; = *empetra* of Pallas, Gmelin, etc.).—RICHARDSON, Parry's Voy. App. 1825, 315; Faun. Bor.-Am. i, 1829, 147, pl. ix (= *empetra* Sabine, and hence mainly *A. monax*).—FISCHER, Synop. Mam. 1829, 343 (in part only).—SCHINZ, Syn. Mam. ii, 1845, 61 (in part only).—GRAY, "Knowsley's Menag. 1846, pl. vii."  
*Mus (Arctomys) empetra* HALL, Can. Nat. and Geol. 1860, 302.  
*Arctomys melanopus* KÜHL, Beltrüge, 1820, 64 (Canada).  
*Arctomys empetra*, β *melanopus* FISCHER, Syn. Mam. 1829, 343 (= *melanopus* Kuhl).  
*Arctomys marnota canadensis* KÜHL, Beltrüge, 1820, 64 (Canada).  
† *Stereodectes tortus* COPE, Proc. Acad. Nat. Sci. Phila. 1869, 3; Proc. Amer. Phil. Soc. Phila. 1869, 179, pl. iii (fossil; bone-caves, Virginia; probably based on an abnormal incisor of *Arctomys monax*).  
"† *Arctomys* ——" LEIDY, Journ. Acad. Nat. Sci. Phila. vii, 1869, 404 (= *Stereodectes tortus* Cope).  
*Le Siffleur*, LA FONTAINE, Voy. dans l'Amér. i, 1703, 233.  
*Monax*, CATESBY, Nat. Hist. Car. App. 1743, xxviii.  
*Monax* or *Marmotte of America*, EDWARDS, Birds, ii, 1745, 104, pl. civ (specimen from Maryland).  
*Glis marmotta, americanus*, KLEIN, Quad. 1751, 56.—BRISSON, Reg. Anim. 1756, 164.  
*La Marmotte d'Amérique*, BRISSON, l. c.  
*Maryland Marmot*, PENNANT, Syn. Quad. 1771, 270; Arctic Zool. i, 1784, 111; ib. 2d ed. 1792, 198 (in part only; mixed with a species of *Capromys*).  
† *Quebec Marmot*, PENNANT, l. c. (probably *A. monax*).  
*Monax gris*, F. CUVIER, Hist. des Mam. livr. xxxvii, 1822.  
*Woodchuck*, *Ground-hog*, vulgo.

**SPECIFIC CHARs.**—Length to base of tail 14.50, varying from 13.00 to 15.50; of tail-vertebræ about 4.50; of tail to end of hairs about 6.75. Color above generally mixed fulvous, brownish-black, and gray; below, yellowish-rufous, varying to brownish-rufous. Top of head, upper surface of all the feet, and the tail usually black or brownish-black; nose and chin gray; sides of the head (below the eyes) and throat yellowish-white; fore limbs and region all round their insertion usually lively rust-red. Varies to wholly brownish-black, varied slightly with pure gray or rusty-gray, and even to nearly uniform intense black. The ears are large, rounded, thinly haired, generally gray, but varying in the darker specimens to brownish-gray, passing into black at their extremities. Tail full, round, and bushy, with the hairs generally considerably less than half the length of the head and body.

Specimens from the same locality vary greatly in color, the gray of the upper parts varying from whitish-gray to yellowish-gray, the black from brownish-black to pure black, and the fulvous from pale fulvous to yellowish. The abundant soft under fur is black or dusky at base, then fulvous, passing into brownish-fulvous. The basal dusky zone occupies from one-third to two-thirds of the whole length of the under fur, the remainder being fulvous, the



proportions of the two colors greatly varying in different specimens, and probably in the same individual at different seasons. The long, coarser, overlying hairs are colored basally like the under fur; the portion of the hairs projecting beyond the under fur is thicker than the basal portion, generally intense black, with the tips clear white, grayish-white, or yellowish-white. The mixed color of the surface results from the fulvous zone being more or less visible through the gray and black surface tints. The ventral surface is thinly haired, and generally almost without under fur. The hairs are here two-colored, being black basally, with the terminal half fulvous or rufous. The tail-hairs are generally wholly black or brownish-black to the base, with generally gray tips, and sometimes an admixture of brownish. The anterior half of the dorsal surface of the body is generally much grayer than the posterior half, the gray sometimes forming a strongly marked gray shoulder-mantle. In No. 1571, from Essex County, New York, the middle and posterior part of the back is black, with the sides of the shoulders gray, presenting nearly the pattern of coloration seen in *Spermophilus grammurus* var. *beecheyi*.

In the large series of New England specimens before me are some almost wholly black throughout, with the sides of the nose and chin gray and the long hairs of the body slightly gray-tipped. Others are brownish-black and more varied with gray; others still are strongly brownish-black posteriorly, and more varied with gray anteriorly and on the sides. In some that present the usual or more general phase of coloration, the top of the head is deep black; in others, brownish-black; in others still, it is scarcely darker than the rest of the dorsal surface. In some, the under fur is pale whitish-fulvous; in others, simply fulvous, varying in still others to rusty-yellow. In the latter, the sides of the breast and the region surrounding the point of insertion of the fore limbs are bright reddish-chestnut, and the whole lower surface is strongly ferruginous, with the hairs lighter-tipped over the middle of the belly. In all the specimens, the feet are all either intense black or deep brownish-black. In one specimen, from Nelson's River, H. B. T., the whole ventral surface is bright reddish-chestnut. There is also a specimen in the collection from the Hudson's Bay Territory wholly black.

Young specimens, one-third to two-thirds grown, are usually much lighter colored than the adults. In these, the under fur is either wholly gray, or gray with a faint tinge of pale fulvous, and the white tips of the hairs are much longer than in older specimens. The pelage is generally thinner, with a peculiar aspect of immaturity.



*Arctomys monax* differs from *A. flaviventer*, its nearest ally, in its smaller size, relatively much shorter tail, larger ears, and quite different coloration. The style of coloration is nearly the same in the two species, both being grizzled above, through the gray tipping of the hairs, and more or less varied with fulvous. *A. flaviventer* is characterized by a more golden hue and by the subterminal bar of the long hairs being reddish-brown instead of black. *A. monax* lacks the pale yellow color of the buttocks seen in *A. flaviventer*, and the whitish-yellow area on the sides of the neck. The feet and tail are also black instead of yellow or yellowish-brown. The difference in size is quite marked, *A. monax* averaging about three inches shorter in the head and body length, while the tail is also three inches shorter than that of *A. flaviventer*, and hence relatively much shorter. Still more strongly marked differences are seen in the skulls. In *A. monax*, as compared with *A. flaviventer*, the palate is broader, the molar series farther apart and strictly parallel, the teeth themselves larger, and the palatal surface smooth; whereas in the latter the molar series are slightly convergent posteriorly, the palatal surface is narrower, absolutely as well as relatively, with a rather deep groove on each side, extending usually from the maxillo-intermaxillary suture to the last premolar, and sometimes considerably beyond this point; the posterior nasal opening is also narrower, and the pterygoid processes more convergent. In *A. monax*, the skull is broader in proportion to its length, the nasals are longer, and the frontals extend further forward, resulting in a much smaller exposure of the maxillary in view from above. The anterior face of the zygomatic process of the maxillary is also much narrower than in *A. flaviventer*. As compared with *A. pruinosus*, all the differences, both cranial and external, are far greater than between *A. monax* and *A. flaviventer*, rendering a detailed comparison unnecessary. In respect to size, *A. pruinosus* must be an animal of twice the bulk and weight of *A. monax*.

As may be inferred from the foregoing remarks, *A. monax* presents a wide range of individual variation in color. It also varies greatly in respect to the characters of the skull, particularly in respect to the length and form of the nasal bones, and the breadth and posterior extension of the premaxillaries. When the nasals are greatly narrowed posteriorly, the intermaxillary becomes proportionally widened, its width opposite the zygomatic process of the maxillary being fully twice as great in some specimens as in others. The adult skull, among specimens from the same locality, varies in length from

about 3.20 to 3.60, and in width from 2.15 to 2.48. Specimens from the United States average about 3.40 in length of skull, and rarely exceed 3.50.

The habitat of *Arctomys monax* extends from the Carolinas northward to Hudson's Bay and Liard River, and westward from the Atlantic coast to Western Missouri, Iowa, and Minnesota. There are specimens in the collection from Nelson's River, H. B. T., James's Bay, Fort Simpson, Fort Chipewyan (Athabasca District), Fort Liard, and Peale's River, that scarcely differ from specimens from New York and New England. Some of them are rather more rufous than the usual phase met with in the United States, but are not apparently otherwise different. According to Mr. B. R. Ross, it ranges northward to latitude 62°. He speaks of obtaining specimens at Lake Athabasca and Salt River, but adds that he thinks its range does not extend beyond Fort Simpson.\* Audubon and Bachman state that it exists sparingly in the mountainous districts of North and South Carolina, but add that it is not found in the maritime districts of either of those States.†

Although the present species has very few synonyms, technically speaking, it has a very complicated history. The specific name *monax* was first given to this animal in 1758 by Linnæus, who based it on the description of the "Monax, or Marmotte of America," of Edwards, whose description and figure were published in 1747, Edwards's work being the only one quoted by Linnæus in either the tenth or the twelfth edition of his *Systema Naturæ*. Edwards's figure was drawn from a living specimen in the possession of Sir Hans Sloane, brought from Maryland. Thus the name *monax* is unequivocally applicable to the Marmot, "Ground Hog", or "Woodchuck" of the Atlantic States. Somewhat before this date, however, Catesby, in his *Natural History of Carolina* (published 1731 to 1743), described and figured an animal called by him the "Bahama Coney"; in the appendix of the same work he described the "Monax". The former belongs to a family wholly unrepresented in the United States, being referable to some species of *Capromys*; perhaps to the *C. fourieri*, as was first suggested by Audubon and Bachman. The latter is the common Marmot of the Atlantic States, the *Arctomys monax* of authors.‡

\* MS. notes in Smithsonian Institution.

† Their reference to its occurrence on the Upper Missouri and in the Rocky Mountains to Texas relates of course to *A. flaviventris*.

‡ As Catesby's vague and unsatisfactory descriptions of these animals have an important historical bearing, I subjoin them in full:—

"CUNICULUS BAHAMENSIS.

"The Bahama Coney.

"This Creature is a little less than the common Wild Rabbit, and of a brown Colour, with a Mixture of gray Hairs. Its Ears, Feet and Tail resemble those of a Rat, in other Parts it is somewhat like

Yet Pennant, in 1771, in his Synopsis of Quadrupeds (as also in all of his subsequent accounts of that animal), referred both of these to his "Maryland Marmot", as he did also the "Monax" of Edwards, the "*Glis marmotta americana*," of Klein, the "*Glis (marmota americana)*" of Brisson, and the *Mus monax* of Linnæus, without apparently having any personal acquaintance with either of them. Although his first reference is to the "Bahama Coney", his description relates mainly to the Maryland Marmot, but in his account of its distribution and habits he includes the "Bahama Coney". Erxleben, in 1777, followed Pennant in referring Catesby's Bahama Coney, and all the subsequent names of Klein, Brisson, and others based thereon, to his *Glis monax*, as well as the "Monax" of Catesby and Edwards, supposing, as did Pennant, that all were referable to the same animal. Erxleben was followed by Gmelin and nearly all systematic writers down to Audubon and Bachman, who appear to have been the first to call attention to the total distinctness of Catesby's two species. Thus the confusion created by Pennant in 1771 continued for fully three-fourths of a century. As late as 1822, Sabine attributed to Erxleben the "credit" of uniting the references of his predecessors, based on Pennant's Monax and Bahama Coney, and of thus correcting their error of regarding them as distinct, while in reality he only greatly emphasized the confusion that originated six years earlier with Pennant, by lending it the authority of his name. As shown in the references given at the head of the present article, Schreber is almost the only one among the early general systematic writers who escaped the error of uniting Catesby's Monax and Bahama Coney.

The only prominent synonym of the *Arctomys monax* is *empetra*, a name originating with Pallas, and based by him on a specimen of *Spermophilus "parryi"*,\* but in his references he cites the Quebec Marmot of both Pennant

a Rabbit. They feed wholly on wild Fruit and other Vegetables: When surpris'd by Hunters they retreat to Holes in Rocks. Their Flesh is esteem'd very good, it has more the Taste of a Pig than that of a Rabbit. I take it to be nearly of the Kind of the *Mus Alpinus*, or Marmot. *Basi Syn. Quad.* p. 291."—(CATESBY, *Nat. Hist. of Carolina, Florida, and the Bahama Islands*, vol. ii, 1743, p. 79, pl. lxxix.)

"MARMOTA AMERICANA.

"The Monax.

"This Animal is about the Bigness of a wild Rabbet; and of a brown Colour, the Head also resembles most that of a Rabbet, except that the Ears are short, like those of a Squirrel; the Feet are like those of a Rat, the Tail is like that of a Squirrel, but much less hairy. It feeds on Bread, Fruit and other Vegetable Diet. At certain Times they retire to their subterraneous Lodgings, and sleep continually a Month or longer together: They are Inhabitants of Maryland, Pennsylvania &c. Their Flesh is esteem'd good Meat."—(CATESBY, *Nat. Hist. of Carolina, Florida, and the Bahama Islands*, App. p. xxviii.)

\* See further the discussion of the synonymy of *Spermophilus empetra* (= *S. parryi* auct.), *ante*, p. 849.

and Forster.\* While the "Québec Marmot" of the latter is also certainly referable to *Spermophilus parryi*, the "Quebec Marmot" of Pennant is in all probability to be assigned to *Arctomys monax*, although the only really tangible character given is, "rather larger than a Rabbit". The *Arctomys empetra* of Schreber is strictly the *Mus empetra* of Pallas, Schreber not only quoting Pallas's diagnosis and references, but also giving a figure of Pallas's *Mus empetra*, furnished him by Pallas himself, and he based his account of the animal mainly on Pallas's description. He, however, eked out the history of the species by a summary of Pennant and Forster's descriptions of their "Quebec Marmot". Thus, with the exception of the reference to Pennant, the *Mus empetra* of Pallas is the *Spermophilus parryi* of later writers. Sabine, however, in 1822, described a specimen of *Arctomys monax*, from Hudson's Bay, under the name *Arctomys empetra*, to which he referred the Quebec Marmot of Pennant and Forster, and the several names based thereon, together with the *Mus empetra* of Pallas. The *Arctomys empetra* of Sabine is properly the *A. empetra* of most subsequent authors down to Audubon and Bachman, who correctly referred the *A. empetra*, as at that time understood, to *A. monax*, after having seen Hudson's Bay specimens of the former in England, and becoming convinced that they were identical. As already stated (see *antea*, p. 843), Sabine noticed the discrepancies between the various accounts of the *Arctomys empetra* of authors, both among themselves and with his specimen, especially the shortness of the tail, as described by Pallas and figured by Schreber. These discrepancies were also referred to by Richardson in 1825.†

The *Glis canadensis* of Erxleben (1777) is based wholly on the Quebec Marmot of Pennant and Forster, and thus certainly refers mainly to the *Arctomys parryi* of Richardson, and (through the reference to Pennant) in part also to the *A. empetra* of Sabine. The *Arctomys melanopus* of Kuhl was based on a specimen of *A. monax*, and is thus strictly and exclusively a synonym of that species. The "*Marmota quebekana* Pennant", cited by Pallas, is merely a citation in Latin of Pennant's English name.

\* "*Marmota quebekana* PENNANT *Syn.* p. 270. *Sp.* 199. tab. 24. f. 2. bona. FORSTER *Act. angl.* vol. LXII. p. 378."

† Parry's Second Voy. App. p. 315.

TABLE CXXXIII.—Measurements of six specimens of *Arctomys monax*.

Catalogue number. Original number.	Locality.	Sex.	From tip of nose to—				Tail to end of—		Length of—		Nature of specimen.	Remarks.
			Eyes.	Ears.	Occiput.	Tail.	Vertebrae.	Hairs.	Fore foot.	Hind foot.		
847 ...	Essex County, N. Y. ....	♂	1.07	3.00	3.00	14.50	4.75	6.75	2.33	3.04	Fresh.	From Baird, Man. N. Amer. p. 343.
854 ...	do. ....	♂	1.50	2.10	3.50	14.00	5.08	7.08	2.46	3.14	do.	
4 ...	Ipswich, Mass. ....	♂	1.17	2.17	.....	9.45	2.50	4.50	.....	2.55	do.	
58 ...	do. ....	♂	1.50	2.05	3.80	13.00	4.48	6.00	2.10	3.10	do.	
55 ...	do. ....	♂	1.07	2.20	3.45	15.50	4.50	6.75	1.95	2.80	do.	
43 ...	Needham, Mass. ....	♂	1.38	2.94	3.45	15.25	5.45	7.60	2.05	2.95	do.	

TABLE CXXXIV.—Measurements of fourteen skulls of *Arctomys monax*.

Catalogue number.	Locality.	Total length.	Greatest width.	Distance between orbits.	Nasal bones, length.	Nasal bones, width behind.	Nasal bones, width before.	Upper incisors from front to molars.	Upper incisors from front to hinder margin of palate.	Upper incisors, height.	Upper incisors, width between external edges.	Upper molars, length taken together.	Lower jaw, length.	Lower jaw, height.
3738	Essex County, N. Y. ....	3.40	2.35	1.80	1.40	0.40	0.68	1.15	2.04	0.55	0.47	0.83	2.35	1.27
9404	do. ....	2.45	2.45	1.15	1.40	0.45	0.70	1.23	2.10	0.70	0.50	0.80	2.45	1.26
3730	do. ....	2.45	2.40	1.29	1.40	0.39	0.70	1.10	2.00	0.53	0.46	0.80	2.40	1.25
9401	do. ....	2.45	2.27	1.15	1.49	0.35	0.70	1.04	2.02	0.70	0.50	0.83	2.25	1.23
9405	do. ....	2.60	2.30	1.36	1.46	0.37	0.72	1.11	2.05	0.70	0.51	0.88	2.30	1.22
3735	do. ....	2.60	2.43	.....	1.50	.....	.....	1.10	2.07	.....	.....	0.88	2.35	1.27
3734	do. ....	2.40	2.48	.....	1.49	.....	.....	1.10	1.96	.....	.....	0.88	2.38	1.27
7065	do. ....	3.55	2.27	.....	1.50	.....	.....	.....	.....	.....	.....	.....	2.35	.....
9403	do. ....	3.37	2.40	.....	1.35	.....	.....	1.08	1.90	.....	.....	.....	2.27	1.19
3929	do. ....	3.35	2.32	.....	1.38	.....	.....	1.06	1.99	.....	.....	.....	2.30	1.25
9409	do. ....	3.50	2.28	.....	1.43	.....	.....	1.12	2.00	.....	.....	.....	2.38	1.30
3604	do. ....	3.42	2.45	.....	1.42	.....	.....	1.12	1.99	.....	.....	.....	2.37	1.25
3715	do. ....	3.16	2.15	.....	1.30	.....	.....	0.96	1.62	.....	.....	.....	2.15	1.10
3740	do. ....	2.27	2.18	.....	1.28	.....	.....	1.08	1.68	.....	.....	.....	2.18	1.15

TABLE CXXXV.—List of specimens examined of ARCTOMYS MONAX.

Catalogue number of skin.	Catalogue number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
4155				Fort Chepeywan, Athabasca Dist.		R. R. Ross	R. Campbell	Skin.
11346			♀	do	Sept. —, 1878	do	John McRae	do
4389				Fort Simpson		H. Kennicott	H. Kennicott	do
5634				do		R. R. Ross	R. R. Ross	do
4660	898			Fort Simpson, Pease River		do	D. Gunn	do
3033				Nelson River		do	do	do
4337	670			James Bay	Sept. 3, 1880	do	R. Gladmore	do
3003				Princeton, Minn.		O. G. Garrison	O. G. Garrison	do
1308				West Northfield		H. Kennicott	H. Kennicott	do
347				Western Missouri		Dr. P. R. Hoy	Dr. P. R. Hoy	do
1077				Racine, Wis.		Prof. S. F. Baird	Prof. S. F. Baird	Skull.
1361				do		Dr. P. R. Hoy	Dr. P. R. Hoy	do
8008				do		do	do	do
1150	2038			Wisconsin		Dr. A. C. Barry	Dr. A. C. Barry	Skin & skull.
5386				Western Missouri		Dr. J. G. Cooper	Dr. J. G. Cooper	Skull.
*858				Norway, Me.		Gray Fund.	R. D. Verrill	Alcoholic.
*928				do		do	do	do
*1503				do		do	do	Skin.
*1306				do		do	do	do
*1310				do		do	do	do
*1549				do		do	do	do
*1539				do		do	do	do
	*776			do		do	do	Skeleton.
	*777			do		do	do	do
	*778			do		do	do	do
	*765			do		do	do	do
	*786			do		do	do	do
	*767			do		do	do	do
	*768			do		do	do	do
	*769			do		do	do	do
	*770			do		do	do	do
	*771			do		do	do	do
	*772			do		do	do	do
	*773			do		do	do	do
	*774			do		do	do	do
	*775			do		do	do	do
*3998				Upton, Me.		do	J. G. Eich	Alcoholic.
	*789	♀		do		do	do	Skull.
	*790	♀		do		do	do	do
	*791	♀		do		do	do	do
	*798			do		do	do	do
	*793			do		do	do	do
*958				Milan, N. H.		J. B. Fulson	J. B. Fulson	Alcoholic.
*146				Concord, Mass.		Horace Mann	Horace Mann	do
*147				do		do	do	do
*2737				do		do	do	do
*3561				Bedford, Mass.		Miss C. Fitch	Miss C. Fitch	do
*3619				Ipswich, Mass.		J. A. Allen	J. A. Allen	do
	*897			Springfield, Mass.		do	do	Skull.
*1340				Hudson, Mass.		Gray Fund.	S. J. J. J.	Skin.
*2535		301		Newtownville, Mass.		do	C. J. Maynard	do

\* In Museum of Comparative Zoology, Cambridge, Mass.

TABLE CXXXV.—List of specimens examined of *Arctomys monax*—Continued.

Catalogue-number of skin.	Catalogue-number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
*1336	.....	.....	♂	Newtonville, Mass.....	.....	Gray Fund.....	C. J. Maynard...	Skin.
*1569	.....	.....	.....	Massachusetts .....	.....	L. Agassiz .....	.....	do.
*1583	.....	.....	.....	do .....	.....	do .....	.....	do.
*1594	.....	.....	.....	do .....	.....	do .....	.....	do.
*1595	.....	.....	.....	do .....	.....	do .....	.....	do.
*1596	.....	.....	.....	do .....	.....	do .....	.....	do.
*1597	.....	.....	.....	do .....	.....	do .....	.....	do.
*1598	.....	.....	.....	do .....	.....	do .....	.....	do.
*2776	.....	.....	.....	Newtonville, Mass .....	.....	Gray Fund.....	C. J. Maynard...	do.
*2777	.....	.....	.....	do .....	.....	do .....	.....	do.
*2778	.....	.....	♂	do .....	.....	do .....	.....	do.
*2779	.....	.....	.....	do .....	.....	do .....	.....	do.
*2780	.....	.....	♂	do .....	.....	do .....	.....	do.
*2781	.....	.....	♂	do .....	.....	do .....	.....	do.
*2782	.....	.....	♂	do .....	.....	do .....	.....	do.
*2783	.....	.....	♂	do .....	.....	do .....	.....	do.
*2784	.....	.....	.....	do .....	.....	do .....	.....	do.
*2785	.....	.....	♂	do .....	.....	do .....	.....	do.
.....	.....	.....	.....	do .....	.....	do .....	.....	Skull.
.....	.....	.....	.....	do .....	.....	do .....	.....	do.
.....	.....	.....	.....	do .....	.....	do .....	.....	do.
.....	.....	.....	.....	do .....	.....	do .....	.....	do.
.....	.....	.....	.....	do .....	.....	do .....	.....	do.
.....	.....	.....	.....	do .....	.....	do .....	.....	do.
1631	.....	.....	.....	Middleboro', Mass .....	.....	J. W. P. Jenks .....	J. W. P. Jenks .....	Skin.
854	1010	.....	♂	Elizabeth, N. J. ....	.....	Prof. S. F. Baird...	Prof. S. F. Baird...	Skin & skull.
847	1903	.....	.....	Essex County, N. Y. ....	.....	.....	.....	do.
1571	2401	.....	.....	do .....	.....	Dr. S. E. Hale .....	Dr. S. E. Hale .....	do.
1577	2404	.....	.....	do .....	.....	do .....	do .....	do.
1573	2403	.....	.....	do .....	.....	do .....	do .....	do.
1575	2405	.....	.....	do .....	.....	do .....	do .....	do.
1574	.....	.....	.....	do .....	.....	do .....	do .....	Skin.
1572	.....	.....	.....	do .....	.....	do .....	do .....	do.
.....	2359	.....	.....	do .....	.....	do .....	do .....	Skull.
.....	3065	.....	.....	do .....	.....	do .....	do .....	do.
.....	3064	.....	.....	do .....	.....	do .....	do .....	do.
.....	3731	.....	.....	do .....	.....	E. Simond .....	E. Simond .....	do.
.....	3734	.....	.....	do .....	.....	do .....	do .....	do.
.....	3735	.....	.....	do .....	.....	do .....	do .....	do.
.....	3738	.....	.....	do .....	.....	do .....	do .....	do.
.....	3739	.....	.....	do .....	.....	do .....	do .....	do.
.....	3740	.....	.....	do .....	.....	do .....	do .....	do.
.....	3898	.....	.....	do .....	.....	do .....	do .....	do.
.....	601	.....	.....	Carlisle, Pa. ....	.....	Prof. S. F. Baird...	Prof. S. F. Baird...	do.
4686	.....	.....	.....	Chester County, Pa. ....	.....	Dr. E. Miehner...	Dr. E. Miehner...	do.
4686	.....	.....	.....	do .....	.....	do .....	do .....	do.
807	.....	.....	.....	do .....	.....	do .....	do .....	do.
7557	8267	.....	.....	Rawlinsburg, Pa. ....	.....	A. Brakley .....	A. Brakley .....	Skin & skull.

\* In Museum of Comparative Zoology, Cambridge, Mass.



## ARCTOMYS FLAVIVENTER Aud. and Bach.

## Rocky Mountain Marmot.

*Arctomys flaviventer* AUDUBON & BACHMAN, Proc. Acad. Nat. Sci. Phila. 1841, 93; Journ. Acad. Nat. Sci. Phila. viii, 1842, 309; Quad. N. Am. iii, 1853, 160, pl. cxxxiv.—WAGNER, Wiegmann's Archiv. ii, 1843, 45.—SCHINZ, Syn. Mam. ii, 1845, 63.—BAIRD, Mam. N. Am. 1857, 343, pl. xlvii, fig. 1 (skull).—BUCKLEY, Nat. Hist. Wash. Terr. pt. iii, 1860, 99, 124.—HAYDEN, Trans. Am. Phil. Soc. Phila. xii, 1863, 146.—MERHAM, U. S. Geol. Surv. of Terr. 6th Ann. Rep. 1872 (1873), 664.—ALLEN, Proc. Bost. Soc. Nat. Hist. xvi, 1874, 394; Bull. Essex Inst. vi, 67, 66.—COORS & YARROW, Wheeler's Expl. and Surv. W. of 100th Merid. v, Zool. 1875, 123.—GRINNELL, Ludlow's Black Hills of Dakota, 1875, 82.

**SPECIFIC CHAR.**—Length to base of tail about 17.00 to 18.50; of tail to end of vertebrae 6.50 to 7.25; of tail to end of hairs 9.00 to 10.00. Above mixed gray, fulvous, and reddish-brown; below yellowish or golden, varying to rufous. The general color also varies to wholly black or brownish-black, as in *A. monax*. Sides of the nose and chin whitish-gray; top of the head dark reddish-brown; tail with the hairs at base pale reddish-brown to black, broadly tipped with yellowish-brown or rufous; feet yellowish-rufous, strongly varied with black. Ears rather small, thinly haired, yellowish-brown, sometimes edged with darker. Tail long, round, full, and bushy, with the hairs fully one-half to more than one-half the length of the head and body.

The specimens before me chance to be quite uniform in coloration, but melanistic specimens are of frequent occurrence. A specimen from Fort Massachusetts, N. Mex., is everywhere dark brownish-black, slightly varied with gray. At Montgomery, Colo., where this species occurs in great abundance, and where I have seen a dozen or more sitting on the rocks at one time within easy rifle range, generally several black ones were to be seen associated with the others, as well as others more or less blackish. Usually the abundant under fur of the dorsal surface is dusky at base, then clear pale fulvous, passing into golden at the extremity. The overlying longer hairs are conspicuously white-tipped, with a broad subterminal bar of reddish-brown. The under surface is very thinly haired, with no under fur. The hairs are here dark reddish-brown at base, broadly tipped with fulvous, the tint varying in different specimens from pale yellowish to bright rufous. The tail is usually faded yellowish-brown at the surface, the hairs deepening into dark reddish-brown or blackish basally. The rump is generally clear yellowish, varied with the whitish-yellow tips of the longer hairs, and hence lighter



than the back. There is generally also a prominent whitish-yellow patch in front of the shoulders on the sides of the neck, where the hairs are also very coarse and stiff.

In young specimens, the under fur is sometimes clear grayish-white, and the white tips of the overlying hairs are also longer than in the adults, with the subterminal zone darker. The rump, the sides of the neck, and a spot at the base of the ears are conspicuously pale yellowish-white. In several very young specimens (apparently but a few weeks old) from Colorado, the whole top of the head is intense black, and there is an abundance of soft under fur on the ventral surface.

*Arctomys flaviventer* differs, as already noted, from *A. monax* in its different coloration, larger size, smaller ears, and relatively much longer tail. Its much longer and much more heavily clothed tail affords at once a readily available distinctive characteristic. The coloration is also much more golden than in *A. monax*. The differences afforded by the skull have also already been detailed under that species.

From *A. pruinosus*, it differs in its much smaller size, as well as in its totally different coloration, and in important cranial differences. A more detailed comparison will be given under *A. pruinosus*.

*Arctomys flaviventer* was first described in 1841 by Audubon and Bachman, from a specimen in the collection of the Zoölogical Society of London, brought by Douglass "from the mountains between Texas and California".

The habitat of this species extends from Western Texas, New Mexico, and Arizona northward throughout the Rocky Mountains to probably beyond the forty-ninth parallel. It occurs also in the Black Hills of Dakota, and specimens are in the collection from California. It is apparently a strictly alpine species. It is very abundant in the mountains of Colorado, occurring chiefly in the neighborhood of timber-line, and ranges to a considerable distance above the forest vegetation, where it makes its home among the rocks. It is to some extent gregarious, like the *A. marmota* of Europe.

TABLE CXXXVI.—Measurements of seven specimens of ARCTOMYS FLAVIVENTER.

Catalogue-number.	Original number.	Locality.	Sex.	From tip of nose to—				Tail to end of—		Length of—		Nature of specimen.
				Eye.	Ear.	Occiput.	Tail.	Vertebra.	Hairs.	Fore foot.	Hind foot.	
*2769	947	Montgomery, Park Co., Colo .....	♂	2.00	3.45	4.00	17.75	6.50	9.00	2.40	2.05	Fresh.
*9179	949	.....do.....	♂	1.95	3.30	3.65	17.03	6.65	8.90	2.15	2.35	..do.
*2768	950	.....do.....	♂	1.99	3.50	4.00	18.50	6.50	9.30	2.50	2.30	..do.
*2767	951	.....do.....	♂	2.10	3.65	4.10	19.25	7.30	10.00	2.45	2.30	..do.
*2768	952	.....do.....	♂	1.30	2.40	2.90	10.00	4.40	5.75	1.80	2.55	..do.
997	60	Fort Dallen, Oreg. Ter.	♂	.....	.....	.....	14.75	4.50	6.50	.....	2.80	..do.
11585		Black Hills	.....	.....	.....	.....	22.00	8.00	10.00	.....	.....	Skin.

\* In Museum of Comparative Zoology, Cambridge, Mass.

† "Much stretched."

TABLE CXXXVII.—Measurements of eight skulls of ARCTOMYS FLAVIVENTER.

Catalogue-number.	Locality.	Total length.	Greatest width.	Distance between orbits.	Zygomatic length.	Zygomatic width behind.	Zygomatic width before.	Upper incisors from front to molar.	Upper incisors from front to hinder margin of palate.	Upper molar, length when together.	Lower jaw, length.	Lower jaw, height.
9372	Black Hills	2.55	2.45	1.05	1.50	0.38	0.74	1.30	2.65	0.77	2.32	1.55
19406	Colorado	2.15	2.00	0.80	1.55	0.37	0.68	0.97	1.73	0.78	2.00	1.10
11697	.....do.....	2.38	2.27	0.90	1.55	0.30	0.70	1.17	1.90	.....	.....	.....
11698	.....do.....	2.65	.....	0.92	1.40	0.38	0.70	.....	.....	.....	.....	.....
*178	Montgomery, Park County, Colo.	2.45	2.32	0.90	1.57	0.35	0.70	1.06	1.90	0.80	2.13	1.10
*177	.....do.....	2.45	2.45	0.80	1.47	0.35	0.66	1.12	2.00	0.77	2.22	1.23
*175	.....do.....	2.65	2.35	0.87	1.60	0.36	0.65	1.37	2.05	0.78	2.35	1.30
*176	.....do.....	3.17	2.10	0.77	1.50	0.37	0.60	1.60	1.55	0.80	2.05	1.14

\* In Museum of Comparative Zoology, Cambridge, Mass.

TABLE CXXXVIII.—List of specimens examined of *ARCTOMYS FLAVIVENTER*.

Catalogue number of skin.	Corresponding number of skull.	Original number.	Sex and age.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
3691	.....	.....	.....	Ft. Massachusetts, N. M.	.....	Capt. Bowman.....	Capt. Bowman.....	Skul.
4659	.....	.....	.....	Western Arizona?	.....	.....	.....	do.
388	4906	.....	.....	Fort Crook, Cal.	June 7, 1889	Capt. John Feilner..	Capt. John Feilner..	Skin and skull.
.....	4631	.....	.....	do.	.....	do.	do.	Skull.
.....	4750	.....	.....	do.	.....	D. F. Parkinson..	D. F. Parkinson..	do.
11498	.....	.....	.....	Colorado	.....	Dr. F. V. Hayden..	J. H. Batty.....	Skin.
11497	.....	.....	.....	do.	.....	do.	do.	do.
9561	.....	.....	.....	Middle Park, Colo.	July 28, 1889	do.	J. Stevenson.....	do.
11494	.....	.....	.....	Colorado	.....	do.	J. H. Batty.....	do.
10753	.....	.....	.....	Fort Ellis, Mont. Ter.	.....	do.	W. B. Platt.....	do.
9820	.....	.....	.....	Yellowstone Lake	.....	do.	F. J. Hume.....	do.
11696	.....	36	.....	Georgetown, Colo.	.....	Lieut. G. M. Wheeler	Dr. J. T. Rothrock	do.
11699	.....	38	.....	do.	.....	do.	do.	do.
967	.....	60	.....	Fort Dallas, Oreg.	May 8, 1895	Gov. L. I. Stevens..	Dr. Geo. Suchley..	do.
.....	.....	.....	.....	Wind River Mts.	.....	Dr. F. V. Hayden..	Dr. F. V. Hayden..	do.
1595	2373	.....	.....	Black Hills, Nebr.	.....	do.	do.	Skin and skull.
4366	4971	.....	.....	Trout Creek	.....	G. N. Trook.....	G. N. Trook.....	do.
51769	178	947	.....	Montgomery Park Co., Colo.	.....	Rocky Mt. Exped..	Allen, Bennett, and Blass.	do.
52770	178	949	.....	do.	.....	do.	do.	do.
52766	.....	950	.....	do.	.....	do.	do.	do.
52767	177	951	.....	do.	.....	do.	do.	do.
52768	175	953	.....	do.	.....	do.	do.	do.

\* In Museum of Comparative Zoology, Cambridge, Mass.

## ARCTOMYS PRUINOSUS Gmelin.

## Hoary Marmot.

*Arctomys pruinus* GMELIN, Syst. Nat. i, 1789, 144 (= Hoary Marmot, Pennant).—SHAW, Gen. Zool. ii, 1801, 181 (same).—SABINE, Trans. Linn. Soc. xiii, 1822, 586 (same).—HARLAN, Faun. Amer. 1825, 169 (same).—RICHARDSON, Zool. Jour. iii, 1828, 518; Faun. Bor.-Amer. i, 1829, 150.—FISCHER, Syn. Mam. 1829, 343.—AUDUBON & BACHMAN, Quac. N. Amer. iii, 1863, 17, pl. ciii.—BAIRD, Mam. N. Amer. 1867, 345.

*Arctomys caligatus* ESCHSCHOLTZ, Zool. Atlas. ii, 1829, 1, pl. vi.—RICHARDSON, Zool. Beechey's Voy. 1830, 7, 19\* (from Eschscholtz).—WAGNER, Suppl. Schreber's Säuget. ii, 1843, 260 (from the same).—SCHINZ, Syn. Mam. ii, 1845, 63 (from the same).—ROSE, Edinb. New Phil. Journ. xiii, 1861, 169; Canad. Nat. and Geol. 1861, 434; Nat. Hist. Rev. 1869, 274 (north to Arctic Circle).—ALLEN, Proc. Bost. Soc. Nat. Hist. xvi, 1874, 264.

*Arctomys okanaganus* KING, Nar. Beck's Journ. ii, 1836, 236, pl. ii.

*Arctomys monax* WAGNER, Suppl. Schreber's Säuget. iii, 1843, 260 (in part).—MIDDENDORFF, Sibirsche Reise, ii, 1853, 85 (in part).—CASSIN, U. S. Expl. Exped. Mamm. 1858, 35 (Fort Okanagan, Oregon).

*Hoary Marmot*, PENNANT, Hist. Quad. ii, 1761, 130; Arct. Zool. i, 1784, 112; 2d ed. 1792, 129.

*Das beringte Marmelthier*, SCHREBER, Säuget. iv, 745 (from Pennant).

Whistler, HARMON, Journ. 1830, 497.

**SPECIFIC CHAR.**—Length of head and body 23.00 to 25.00; of tail to end of vertebrae 6.50 to 7.75; to end of hairs 9.25 to 10.50. Above, anteriorly, clear grayish-white, varied with black; posteriorly grayish-fulvous and

black; below clear whitish-gray. A small occipital area and the feet black. Head anteriorly, with the sides of the muzzle and the chin, white or grayish-white, and the top of the nose generally black. Ears quite small, well clothed, and nearly concealed by the surrounding pelage. Tail full and round, with the hairs rather less than one-half of the length of the head and body. The hairs are yellowish-white externally, slightly varied with black, and dark reddish-brown basally.

Different specimens vary in the amount of black mixed with the gray and in the intensity of the fulvous suffusion posteriorly. The anterior two-thirds of the dorsal surface is often nearly white, with a slight admixture of black-tipped hairs; at other times, the black and white are present in nearly equal proportions, while again the black predominates. The posterior third of the dorsal surface, together with the tail, is generally more or less suffused with pale whitish-fulvous, sometimes varying to deep fulvous. The pelage is very soft and full, and the under fur very abundant and long. Anteriorly it is brownish-black at base, and clear white apically, or with a slight tinge of yellowish; posteriorly the basal zone is more strongly brownish, with the apical zone pale whitish-yellow. Many of the longer overlying hairs are wholly clear white; others are colored basally like the under fur, with the tips pure black. The lower surface is rather thinly haired, with, however, more or less under fur. The hairs are mostly pure white to the base; the scanty under fur is brownish, and shows to a greater or less extent through the surface hairs, giving a dingy brownish-white appearance to the ventral surface. Some of the long hairs are wholly black, and others are black-tipped. Occasionally the ventral surface is quite strongly tinged with rufous. In a half-grown specimen, the ventral surface is much more thickly clothed than in the adults.

One specimen from Fort Yukon (collector's No. 258) has the hinder part of the back spotted with black and dark chestnut, arranged in large irregular patches. In this specimen, the whole upper surface of the head is black, mixed slightly with gray; the nose and the edge of the chin are also black. The muzzle and chin are usually white, and the top of the head black, but the black area is of irregular outline and of variable extent. The white area on the nose is sometimes very restricted, and again extends posteriorly to a point opposite the eyes, extending back laterally so as to form a broad band over each eye; in other specimens, the black area reaches later-

ally to the eyes. Generally the feet are wholly intense black, but are sometimes more or less mixed with gray. In one specimen (No. 5603), the fore feet are about one-half gray and one-half black, the gray and black being intermixed in irregular patches; the hind feet of the same specimen are mostly black. In other respects than those above noted, the series of eleven specimens before me is quite uniformly colored.

*A. pruinus* differs from the other American species of *Arctomys* in being much larger than either, and in its wholly different coloration. In respect to cranial characters, it differs from *A. monax* not only greatly in the size of the skull but in the posterior convergence of the molar series, in this latter respect agreeing with *A. flaviventer*. It differs, however, quite markedly from both *A. monax* and *A. flaviventer* in respect to the form of the anterior border of the frontals. The suture separating the frontals from the nasals, intermaxillaries, and maxillaries forms a nearly straight line in *A. pruinus*, while in both *A. monax* and *A. flaviventer* the nasals extend considerably beyond the intermaxillaries, while the latter also extend beyond the maxillaries. Hence, in *A. pruinus*, the frontals terminate more anteriorly and in a nearly straight line, instead of being deeply and irregularly hollowed, as in *A. monax* and *A. flaviventer*, in which only an angular portion extends forward laterally between the intermaxillaries and nasals and the edge of the orbits.

In size and coloration, *A. pruinus* bears a much closer resemblance to the *A. marmota* of Europe than to either of the other American species, especially in coloration. *A. pruinus*, however, has, like the other American species, a rudimentary thumb, with a small but distinct flat nail, which is wholly wanting in *A. marmota*. *A. pruinus* has, however, rather the longer tail, and is larger. The skulls of the two also present several points of resemblance, particularly in the straight or nearly straight suture between the frontals and the nasals, intermaxillaries, and maxillaries.

The Hoary Marmot was first described by Pennant\* in 1781, from a specimen (as Richardson tells us) in the Leverian Museum, said to have been brought from Hudson's Bay. "That specimen", adds Richardson, "is now

\* "Marmot. With the tip of the nose black: ears short, and oval; cheeks whitish: crown dusky and tawny: hair in all parts rude and long; on the back, sides, and belly, cinereous at the bottom, black in the middle, and tipped with white, so as to spread a hoariness over the whole: legs black: claws dusky: tail full of hair, black and ferruginous. Size of the preceding [Maryland Marmot]. Inhabits the northern parts of North America."

lost, and the species does not appear to have come under the notice of any other naturalist." Gmelin's name *Arctomys pruinosus* was based wholly on Pennant's description of the Hoary Marmot, as are all subsequent references to this species down to 1829, when Richardson added some further information to the history of the species. He identified with it the Whistler of Harmon, and says, if this reference is correctly made, "we may soon hope to know more of it, for the traders who annually cross the Rocky Mountains from Hudson's Bay to the Columbia and New Caledonia are well acquainted with it." He later adds that "Mr. Macpherson describes one killed in the month of May on the south branch of the Mackenzie as follows:—'It was  $27\frac{1}{2}$  inches long, of which the head  $2\frac{1}{2}$ , and the tail  $8\frac{1}{2}$ . It is, I think, of the same genus with the Quebec Marmot. In the fore-teeth, and in the shape of the head and body, it resembles a beaver. The hair, especially about the neck and shoulders, is rough and strong. The breast and shoulders, down to the middle of the body, is of a silver-gray colour; the rest of the body and the brush are of a dirty yellowish or brown. The head and legs are small and short in proportion to the body.'

"Mr. Harmon represents them as about the size of a badger, covered with a beautiful long silver-gray hair, and having long bushy tails. Mr. Drummond says they resemble the badger of the plains (*Meles Labradorica*) in colour, but are of rather smaller size."\* The animal thus indicated is represented by a considerable series of specimens in the collection of the National Museum, mostly from Arctic America. The *Arctomys pruinosus* of the present article is unquestionably the *Arctomys pruinosus* of Richardson, and there seems to me to be no reason to question the reference of the Hoary Marmot of Pennant, and hence the *Arctomys pruinosus* of Gmelin, to the same species.

In 1829, the year following the publication of Richardson's first notice of his *Arctomys pruinosus*, Eschscholtz figured and described an *Arctomys caligatus* from specimens obtained near Bristol Bay, on the northwest coast, which is unquestionably referable to the *Arctomys pruinosus* of Richardson. Richardson himself, in 1839, notes the great resemblance between the two animals. In 1836, King, in the Narrative of Captain Back's Overland Expedition to the Arctic Sea, redescribed the species as *Arctomys okanaganus*. Of this species Richardson says, in the Zoölogy of Beechey's Voyage (p. 12\*),

\* Fauna Bor.-Amer. vol. I, 1830, pp. 150, 151. See also Zool. Journ. vol. III, 1838, p. 518.

under the head of *A. caligatus*:—"There is a living animal of this species now in the Zoological Gardens. It was brought to England by Mr. King, Surgeon to Captain Back's overland Expedition, and is figured and described in his recent work under the appellation of *Arctomys ochanaganus*, derived from the river upon whose banks it was caught. The *Arctomys pruinosus* of Pennant is perhaps the same with *caligatus*, but the brief account of it in Arctic Zoölogy is insufficient to determine." This specimen, as Audubon and Bachman inform us, is also the original of their *Arctomys pruinosus*, to which they likewise refer the *A. caligatus* of Eschscholtz.

Middendorff, in 1851, partly from a comparison of descriptions and figures and partly upon theoretical grounds, considered the large Marmot of Kamtschatka as specifically identical with the *A. pruinosus* of Audubon and Bachman, both of which (including also the *A. empetra* of authors and the *A. melanopus* of Kuhl) he considered as identical with *A. monax*. Hence he strangely employs this name for the designation of the Kamtschatkan species, previously named *A. camtschatica* by Brandt. At the same time, he was inclined to regard the *A. caligatus*, owing mainly to differences of color, as distinct from the Kamtschatkan Marmot and from the *A. monax* of North America.

Dr. Richardson, apparently on the authority of Harmon and the fur traders, gave the range of *A. pruinosus* as extending from latitude  $46^{\circ}$  to  $62^{\circ}$  in the Rocky Mountains. Pennant's specimen is said to have come from Hudson's Bay, and there are specimens in the present collection from Washington Territory, Forts Good Hope, Liard, and Yukon, in the Mackenzie River District, and from Fort Henry, Alaska. Ross gives its range as extending northward to the Arctic Circle. It hence probably ranges from the Columbia River northward, west of the Rocky Mountains to the Barren Grounds, thence eastward to Lake Athabasca, and possibly to Hudson's Bay. All the specimens in the collection of the National Museum, however, from the region about Hudson's Bay, belong to *A. monax*.

TABLE CXXXIX.—Measurements of three specimens of ARCTOMYS PRUINOSUS.

Catalogue-number.	Original number.	Locality.	From tip of nose to—			Tail to end of—		Length of—		Extremes of specimens.
			Eye.	Occiput.	Tail.	Vertebrae.	Hairs.	Fore foot.	Hind foot.	
5610	1099	Fort Liard.....	.....	.....	34.00	6.75	9.95	9.50	3.75	Shin.
5608	1098	.....do.....	.....	.....	35.50	7.75	10.50	.....	.....	.....do.
5603	1051	.....do.....	1.85	1.90	33.50	6.50	9.95	9.30	3.35	.....do.



TABLE CXL.—Measurements of seven skulls of ARCTOMYS PRUINOSUS.

Catalogue-number.	Locality.	Total length.	Greatest width.	Distance between orbits.	Nasal bones, length.	Nasal bones, width behind.	Nasal bones, width before.	Upper incisors from front to molars.	Upper incisors from front to hinder margin of palate.	Upper incisors, height.	Upper incisors, width between external angles.	Upper molars, length taken together.	Lower jaw, length.	Lower jaw, height.
6870	Washington Territory .....	4.15	2.75	1.35	1.75	0.40	0.60	1.40	2.50	0.80	0.62	1.00	2.20	1.47
6862	.....do .....	3.95	2.52	1.22	1.66	0.37	0.60	1.33	2.45	0.75	0.60	0.85	2.55	1.35
3676	.....do .....	4.05	2.55	1.17	1.75	0.37	0.60	1.37	2.40	.....	.....	1.00	2.65	1.34
3677	.....do .....	4.10	.....	1.24	1.65	0.40	0.65	1.24	2.30	.....	.....	0.92	.....	.....
3675	.....do .....	.....	2.50	1.25	1.58	0.39	.....	1.25	2.17	.....	.....	0.90	2.56	1.25
6861	.....do .....	.....	.....	1.56	0.30	.....	.....	1.22	2.05	.....	.....	0.72	2.40	1.30
4750	.....do .....	3.70	.....	1.03	1.65	0.30	.....	1.28	2.10	.....	.....	0.77	2.35	1.35

TABLE CXLI.—List of specimens examined of ARCTOMYS PRUINOSUS.

Catalogue-number of skin.	Catalogue-number of skull.	Original number.	Sex.	Locality.	When collected.	From whom received.	Collected by—	Nature of specimen.
5788	.....	.....	♀	Fort Good Hope .....	Oct. —, 1884	C. P. Gaudet .....	C. P. Gaudet .....	Skin.
9493	.....	.....	.....	Fort Henry, Alaska .....	May 16, 1889	F. Blachoff .....	F. Blachoff .....	do.
5610	1059	.....	.....	Fort Liard .....	.....	B. R. Ross .....	W. L. Hardisty .....	do.
5009	1058	.....	.....	.....do .....	.....	.....	.....	do.
5008	1051	.....	.....	.....do .....	.....	.....	.....	do.
5403	539	.....	.....	.....do .....	.....	.....	A. McKensie .....	do.
5611	1053	.....	.....	.....do .....	.....	.....	W. L. Hardisty .....	do.
.....	166	.....	.....	Camp Chiloweyuck, W. T. ....	Sept. 18, 1858	A. Campbell .....	Dr. C. B. R. Kennerly .....	do.
.....	170	.....	.....	Fraser's River, W. T. ....	Sept. 12, 1858	.....	.....	do.
.....	.....	.....	.....	Fort Liard .....	.....	B. R. Ross .....	W. L. Hardisty .....	do.
.....	.....	.....	.....	.....do .....	Sept. 18, 1858	.....	.....	do.
.....	859	.....	.....	Fort Yukon .....	Dec. 30, 1861	.....	J. Lockhart .....	do.
.....	858	.....	.....	.....do .....	Dec. 30, 1861	.....	.....	do.
.....	173	.....	.....	Camp Chiloweyuck, W. T. ....	.....	A. Campbell .....	Dr. C. B. R. Kennerly .....	do.
.....	3673	.....	.....	Washington Territory .....	.....	.....	.....	Skull.
.....	3675	.....	.....	.....do .....	.....	.....	.....	do.
.....	3676	.....	.....	.....do .....	.....	.....	.....	do.
.....	3677	.....	.....	.....do .....	.....	.....	.....	do.
.....	3678	.....	.....	.....do .....	.....	.....	.....	do.
.....	6870	.....	.....	.....do .....	.....	.....	.....	do.
.....	6871	.....	.....	.....do .....	.....	.....	.....	do.
.....	6862	.....	.....	.....do .....	.....	.....	.....	do.

## EXTINCT AMERICAN SCIURIDÆ.

Many species of extinct Rodents have recently been made known by Dr. Leidy and Professors Marsh and Cope from the Tertiary deposits of

50 M



Nebraska, Wyoming, Utah, Colorado, and New Mexico, as well as from bone-caves and Quaternary deposits of the East. Within the last six years, more than fifty species have been named, but very few of them can be said to have been characterized, owing to the imperfect nature of the materials from which they have been made known. In 1873, Dr. Leidy described and figured remains of six species in his great work entitled "Contributions to the Extinct Vertebrate Fauna of the Western Territories",\* of which four were referred to the *Sciuridae* and two doubtfully to the *Muridae*. Professor Marsh, in 1871 and 1872, gave preliminary descriptions, without figures, of ten or twelve species, in the American Journal of Science and Arts (vols. ii and iv, 3d series), of which a large part are doubtless referable to the *Sciuridae*, but in many instances no conjecture is offered respecting their affinities. In nearly every case, the species were described from one or two imperfect jaw fragments, containing one or more molar teeth, but in one or two instances merely from isolated molars. Professor Cope, in various papers, has described a still larger number, making altogether about fifty-four species, and sixteen genera, all more or less imperfectly indicated. In many cases, owing to the fragmentary and extremely unsatisfactory nature of the remains on which the diagnoses have necessarily been based, the affinities of many of the genera can scarcely be even conjectured. Some are positively referable to the *Muridae*, others to the *Castoridae*, *Leporidae*, and *Hystricidae*, while many others are unquestionably referable to the *Sciuridae*. Other remains belong to families unrepresented in the existing fauna, as the *Ischyromyidae* and *Castoroididae*.

Remains of *Glîres* have been found in great variety in the Tertiary (Eocene) deposits of the Upper Green River and its tributaries, and in portions of Colorado, Dakota, and Nebraska. Other remains, in part referable to species still existing, but mainly to extinct species of existing genera, have been found in the caves of Pennsylvania and Virginia, and in the crevices of the lead-bearing rocks of Illinois and Wisconsin in deposits of Quaternary age. In a few instances, as in the case of *Palaeolagus* in Colorado, large numbers of specimens of the same species have been found, but generally the species are known as yet from merely a few imperfect fragments of jaws.

In respect to the *Sciuridae*, the bone-caverns of Pennsylvania and Virginia have afforded remains of extinct species of *Tamias* and *Sciurus*, but,

\* Final Reports of the U. S. Geol. Surv. Terr. vol. 1, Fossil Vertebrates, part 1, 1873.

with possibly one exception,\* the remains from the Tertiary deposits of the West belong to wholly extinct genera. The genera of this family, most abundant in the Eocene deposits, and which may be unquestionably referred to the *Sciuridæ*, are *Paramys* and *Sciuravus*, which are not apparently very distantly related. The remains referred to these genera indicate species ranging in size from animals smaller than *Sciurus hudsonius* to those one-fourth larger than *Arctomys monax*. Other apparently Sciurine forms are the genera *Taxymys* Marsh, *Tillomys* Marsh, *Heliscomys* Cope, and possibly *Colonomys* Marsh, and some of the species referred to *Gymnoptychus* Cope. *Gymnoptychus chrysodon* is said to lack postorbital processes, which at once excludes it from the *Sciuridæ*, although the genus has been referred by its author to this family, together with *Ischyromys* Leidy.†

As the majority of the extinct species of *Sciuridæ* have been described from merely lower-jaw fragments, it is not unlikely that, if they ever become better known, some of the larger genera, as *Paramys*, *Sciuravus*, and *Gymnoptychus*, will be found to embrace species not strictly congeneric; it being presumable from analogy that species ranging in size from the size of a large Mouse to that of a large Marmot will hardly prove to be referable to the same genera.

The subjoined account of the extinct forms of *Sciuridæ* is necessarily, from the circumstances of the case, merely a compilation from the original authorities. All that is aimed at is to give a connected synopsis of the subject, embracing the leading characteristics of the described forms, with their localities of occurrence, their approximate size, a notice of the data on which our knowledge of them at present rests, and references to the original papers in which they have been described or noticed. This, owing to the scattered state of the literature of the subject, it has been thought might prove useful to the general student and also to specialists.

#### SCIURUS CALYCINUS Cope.

*Sciurus calycinus* COPE, Proc. Amer. Phil. Soc. xii, 1871, 86.

Described from "two imperfect rami of the lower jaw, with the incisor and first, second, and third inferior molars *in situ*", found in the Port Ken-

\* Professor Cope refers one species from Colorado, described first as a *Paramys*, to *Sciurus*, remarking that the remains thus referred do "not differ in any degree from corresponding parts of the existing *Squirrels*".—(*Ann. Rep. U. S. Geol. Surv. Terr. for 1873* (1874), p. 475.)

† *Ibid.* p. 474.

nedly bone-cave, Montgomery County, Pennsylvania. These remains indicate a species much larger than *S. panolius* Cope, and agreeing in size with *S. hudsonius*, to which it seems not unlikely referable.

#### SCIURUS PANOLIUS Cope.

*Sciurus panolius* COPE, Proc. Amer. Phil. Soc. xi, 1869, 174, pl. iii, fig. 5.

This species is based on a portion of a mandibular ramus "containing two molar teeth, and the included portion of the incisor, the coronoid and vertical ramus being lost". It is from the caves of Wythe County, Virginia. This fragment indicates a species about two-thirds the size of *Sciurus hudsonius*, and appears to differ considerably in other respects from the corresponding portion of the lower jaw of *S. hudsonius*. While its size is that of *Tamias striatus*, it is a true *Sciurus*, and the smallest species of the genus thus far known from North America.

#### SCIURUS RELICTUS Cope.

"*Paramys relictus* COPE, Synop. New Vert. of Colorado, 1873, 3."

*Sciurus relictus* COPE, Ann. Rep. U. S. Geol. Surv. Terr. for 1873 (1874), 475.

"Size that of the Chickaree (*Sciurus hudsonius*).". Described from "two left mandibular rami, with all the teeth complete". Said to "not differ in any degree from corresponding parts of the existing Squirrels". Found in the "Tertiary of Colorado", the exact locality not being given.

#### TAMIAS LÆVIDENS Cope.

*Tamias lævidens* COPE, Proc. Amer. Phil. Soc. xi, 1869, 174.

This species, described from "the distal half of a mandibular ramus", with the first molar teeth in place, is too imperfectly known to enable one to say much respecting its character or affinities. Its size seems to have been that of *T. striatus*, from which species it, however, differs in several important particulars. In *T. lævidens*, the first lower molar has two anterior cusps, as in *T. lateralis* and *T. asiaticus* var. *quadrivittatus*, instead of the single one seen in *T. striatus* and *T. harrisi*. The portion of the ramus anterior to the molars is also slenderer than in *T. striatus*, and the incisors lack the fine striations of the anterior surface seen in the last-named species, but have "three narrow grooves on the outer longitudinal angle". From the bone breccias of caves, Wythe County, Virginia.

## ARCTOMYS VETUS Marsh.

*Arctomys vetus* MARSH, Amer. Journ. Sci. and Arts, 3d ser. II, 1871, 121.

About one-third as large as *Arctomys monax*. Described from a nearly perfect lower jaw and other remains. Lower incisors with a shallow median groove on the anterior surface. Loup Fork, Northern Nebraska; Pliocene.

## GENUS PARAMYS Leidy.

*Paramys* LEIDY, Proc. Acad. Nat. Sci. Phila. 1871, 231; Ann. Rep. U. S. Geol. Surv. Terr. for 1871 (1872), 357; Extinct Vert. Fauna, 1873, 100.

Although half a dozen or more species of *Paramys* have been described, the genus is thus far known only from more or less imperfect mandibular rami. It was first described by Dr. Leidy, in 1871, from remains discovered by Dr. Carter in Tertiary deposits near Fort Bridger, Utah, who recognized three species from as many fragments of lower jaws. Professor Marsh and Professor Cope have each since described a single additional species from the Tertiary of Western Wyoming and Colorado. The largest of these species (*Paramys robustus* Marsh) exceeds in size the common Marmot (*Arctomys monax*), while the smallest (*Paramys relictus* Cope, perhaps not strictly referable to this genus) is not larger than the common Chickaree (*Sciurus hudsonius*). As in all the other genera of the *Sciuridæ*, the lower grinding teeth are four in number on each side, with short, square, tuberculate, enameled crowns, with the same concave surface and tuberculate corners as in other genera.

"The lower jaw is proportionally shorter and deeper than in most known Rodents, the reduction in length being mainly due to a less development of that part of the bone in advance of the molars. To compensate for difference in length, and to make room to accommodate the incisors, these teeth reach farther back than usual. In Squirrels and Marmots their posterior extremity reaches a short distance behind and beneath the last molar. In *Paramys* it reached further backward, upward, and externally to a level with the crown of the last molar. The jaw in advance of the molars is not only short compared with the usual condition in most known Rodents, but the acute edge of the hiatus between the molars and incisors is almost on a level with the alveoli of the teeth, instead of forming a deep concave notch, so conspicuous a feature of the jaw of the Gnawers generally. The ridge defining the muscular fossa on the back part of the jaw is strongly pronounced, indicating powerful masticatory muscles."—(Leidy.)

## PARAMYS ROBUSTUS Marsh.

*Paramys robustus* MARSH, Amer. Journ. Sci. and Arts, iv, 1872, 218.

One of the largest of the known species of *Paramys*, being "somewhat larger than the common Woodchuck (*Arctomys monax* Gmel.)". Described by Professor Marsh from "two lower molars" and "other less important remains". Lower Tertiary deposits of Grizzly Buttes and Henry's Fork, Wyoming.

## PARAMYS LEPTODUS Cope.

*Paramys leptodus* COPE, Pal. Bull. no. 12, 1873, 3.

"About the size of *P. delicatus* Leidy, and *P. robustus* Marsh, but with smaller incisors, which have little more than half the diameter of the same tooth in those species. The molars have two anterior separate, and three posterior contiguous cones, the median smallest. The anterior and posterior of both sides separated by a deep excavation. The anterior tooth is peculiar in its greater compression. The posterior tubercles are not separated, and the anterior inner situate behind the outer, and connected with the posterior inner by a concave ridge." Length of the molar series 221<sup>mm</sup>; antero-posterior diameter 38<sup>mm</sup>; transverse 24<sup>mm</sup>. Described from a right mandibular ramus with all the teeth preserved. South Bitter Creek, Wyoming.

## PARAMYS DELICATUS Leidy.

*Paramys delicatus* LEIDY, Proc. Acad. Nat. Sci. Phila. 1871, 231; Ann. Rep. U. S. Geol. Surv. Terr. for 1871 (1872), 357; Extinct Vert. Fauna (Final Rep. U. S. Geol. Surv. Terr. vol. I), 1873, 110, 335, pl. vi, figs. 23-25.—COPE, Pal. Bull. no. 12, 1873, 4.

Size about one-fourth less than *Arctomys monax*. Length of the lower molar series 0.75 of an inch; antero-posterior diameter of the lower incisor 0.17; transverse diameter 0.13. Eocene beds near Fort Bridger (*Leidy*), and Black's Fork, Southwestern Wyoming (*Cope*). Described and figured by Dr. Leidy (*l. c.*) from two specimens sent to him by Dr. Carter, "consisting of portions of the right and left sides of the lower jaw, containing most of the molars and portions of the incisors".

## PARAMYS DELICATIOR Leidy.

*Paramys delicatior* LEIDY, Proc. Acad. Nat. Sci. Phila. 1871, 231; Ann. Rep. U. S. Geol. Surv. Terr. for 1871 (1872), 357; Extinct Vert. Fauna, 1873, 110, 335, pl. vi, figs. 26, 27, pl. xxvii, figs. 16-18.—COPE, Pal. Bull. no. 12, 1873, 4.

Rather smaller than the preceding, and collected by Dr. Carter from the same locality. Length of the lower molar series 0.62 of an inch; antero-

posterior diameter of lower incisor 0.17; transverse 0.125. Described and figured by Dr. Leidy (*l. c.*) from the greater portion of a left mandibular ramus and several detached molar teeth. From Fort Bridger, Utah, and also reported by Professor Cope (*l. c.*) from Cottonwood Creek and Black's Fork, Southwestern Wyoming.

#### PARAMYS DELICATISSIMUS Leidy.

*Paramys delicatissimus* LEIDY, Proc. Acad. Nat. Sci. Phila. 1871, 231; Ann. Rep. U. S. Geol. Surv. Terr. for 1871 (1872), 357; Extinct Vert. Fauna, 1873, 112, 335, pl. vi, figs. 28, 29.—COPE, Pal. Bull. no. 12, 1873, 4.

Smaller than either of the preceding, and from the same localities. Length of the lower molar series 0.50 of an inch; antero-posterior diameter of the lower incisor 0.125; transverse 0.083. Described and figured by Dr. Leidy (*l. c.*) from "the greater portion of the right ramus of a lower jaw, containing all the molars, and a second specimen consisting of a small fragment of another lower jaw containing the second molar". Fort Bridger (*Leidy*) and Black's Fork (*Cope*).

#### GENUS SCIURAVUS Marsh.

*Sciuravus* MARSH, Amer. Journ. Sci. and Arts, 3d ser. ii, 1871, 122.

Upper molars with two pairs of tubercles, and a minute intermediate cone on the outer edge. The lower incisors extend below the entire molar series.

#### SCIURAVUS NITIDUS Marsh.

*Sciuravus nitidus* MARSH, Amer. Journ. Sci. 3d ser. ii, 1871, 122.—LEIDY, Ann. Rep. U. S. Geol. Surv. Terr. for 1871 (1872), 358.

"About the size of the Brown Rat (*Mus decumanus*)."

 Described from a portion of an upper jaw containing the last three molars. Found at Grizzly Buttes, near Fort Bridger, Wyoming.

#### SCIURAVUS UNDANS Marsh.

*Sciuravus undans* MARSH, Amer. Journ. Sci. and Arts, 3d ser. ii, 1871, 122.—LEIDY, Ann. Rep. U. S. Geol. Surv. Terr. for 1871 (1872), 358.  
*Paramys undans* COPE, Pal. Bull. no. 12, 1873, 4.

Rather larger than the Brown Rat (*Mus decumanus*); smaller than *Paramys delicatissimus* Leidy. Described by Professor Marsh (*l. c.*) from a portion of a lower jaw containing the incisors and the first three molars, from

Grizzly Buttes, Wyoming. Cited by Professor Cope as also occurring on the Upper Green River. Professor Cope considers this species as generically identical in dentition with *Paramys*, to which genus he refers it, as above cited.

#### SCIURAVUS PARVIDENS Marsh.

*Sciuravus parvidens* MARSH, Amer. Journ. Sci. and Arts, 3d ser. iv, 1873, 320.

Half the size of *Sciuravus undans*, with the lower incisor more convex in front than in that species. Described from a "lower jaw containing the third molar, and part of an upper jaw with the penultimate molar, and several isolated teeth". From Henry's Fork and Grizzly Buttes, Wyoming.

#### †SCIURAVUS ——— Leidy.

† *Sciuravus* ——— LEIDY, Extinct Vert. Fauna, 1873, 113, 335, pl. vi, fig. 30.

Size of the last. Described and figured by Dr. Leidy (*l. c.*) from part of a mandibular ramus, containing the third molar and the alveoli of the second and fourth molars, from Grizzly Buttes, Wyoming. Referred doubtfully to this genus by Dr. Leidy, it being considered by him as not referable to *Paramys*.

#### GENUS HELISCOMYS Cope.

*Heliscomys* COPE, "Synop. New Vert. Colorado, 1873, 3"; Ann. Rep. Geol. Surv. Terr. for 1873 (1874), 475.

"Inferior molars four; the crowns supporting four isolated cones in pairs. This genus is only known from mandibular rami. These resemble in their dental structure some of the *Muridae*, but the number of molars is more, as in *Sciuridae*."

#### HELISCOMYS VETUS Cope.

*Heliscomys vetus* COPE, "Synop. New Vert. Colorado, 1873, 4"; Ann. Rep. Geol. Surv. Terr. for 1873 (1874), 475.

Smaller than *Sciurus hudsonius*. "The least mammal of the fauna to which it pertains." "First molar with only three cones; all the molars except the first with a broad continuous cingulum on the external side. Ramus rather stout; incisor-teeth very slender, elongate, slightly compressed, with parallel sides and convex anterior surface." From the "Tertiary of Colorado".

#### GENUS MYSOPS Leidy.

*Mysops* LEIDY, Proc. Acad. Nat. Sci. Phila. 1871, 232; Ann. Rep. U. S. Geol. Surv. Terr. for 1871 (1872), 357; Extinct Vert. Fauna, 1873, 111.

"The jaw in its form, proportions, and construction, and the number of

teeth and their relative position, agree with the conditions in *Paramys*, but the form of the molars is sufficiently different to refer the specimen to a different genus, for which the above name has been proposed. The [lower] molar teeth, as in *Paramys*, are four in number, inserted each by a pair of fangs. The crowns are quadrate and invested with enamel. The triturating surface, instead of being constructed like that of the Squirrels, is more like that of the Rats. . . . The crown of the third molar exhibits two transverse lobes, or ridges, joined by an intermediate narrow ridge, and the inner surface of the lobes include a trilateral tubercle. . . . The last molar exhibits three transverse ridges or lobes, of which the anterior is the thickest, the middle one the thinnest, and the posterior the shortest. . . . The anterior molar of *Mysops*, like the last one, is more elongated fore and aft than the two succeeding molars, but is proportionally of less size than in the Rats, and has not three fangs, as in these animals. . . . The jaw is proportionately deep and short, compared with that of the Rat. The masseteric fossa is deep, and defined by a rectangle, the apex of which reaches as far forward as the position of the third molar tooth. The border of the jaw at the hiatus in advance of the molars extends nearly on a level from their alveoli to that of the incisor." The skull remains unknown. Described from remains found by Dr. Carter at Grizzly Buttes, Wyoming.

Animals of small size, scarcely larger than the common Mouse (*Mus musculus*).

This genus was doubtfully referred by Dr. Leidy, in 1873, to the *Muride*, but its affinities are apparently more Sciurine than Murine.

#### MYSOPS FRATERNUS Leidy.

*Mysops fraternus* LEIDY, Extinct Vert. Fauna, 1873, 112, 336, pl. xxvii, figs. 14, 15.

Size of the common Mouse (*Mus musculus*). Described from a portion of a right ramus of a lower jaw containing the last three molars. Length of the molar series about 0.26 of an inch; depth of the jaw at the third molar 0.21. Grizzly Buttes, Wyoming.

#### MYSOPS MINUTUS Leidy.

*Mysops minutus* LEIDY, Proc. Acad. Nat. Sci. Phila. 1871, 232; Ann. Rep. U. S. Geol. Surv. Terr. for 1871 (1872), 367; Extinct Vert. Fauna, 1873, 111, 336, pl. vi, figs. 31, 32.

Size of the last. Described from a ramus of the lower jaw, containing two molars. Grizzly Buttes, Wyoming.



## GENUS COLONYMYS Marsh.

*Colonymys* MARSH, Amer. Journ. Sci. and Arts, 3d ser. iv, 1872, 220.

Known only from several isolated molar teeth of an apparently Sciurine character.

## COLONYMYS CELER Marsh.

*Colonymys celer* MARSH, Amer. Journ. Sci. and Arts, 3d ser. iv, 1872, 220.

About half the size of the Brown Rat (*Mus decumanus*). Known, like the genus, only from a few detached molar teeth, from the Tertiary deposits of Henry's Fork, Wyoming.

## GENUS TAXYMYS Marsh.

*Taxymys* MARSH, Amer. Journ. Sci. and Arts, 3d ser. iv, 1872, 219.

Apparently allied to the true Squirrels, but too imperfectly known to admit of characterization.

## TAXYMYS LUCARIS Marsh.

*Taxymys lucaris* MARSH, Amer. Journ. Sci. and Arts, 3d ser. iv, 1872, 219.

Rather smaller than the Flying Squirrel (*Sciuropterus volucella*). Described from a portion of an upper jaw, with the first two molars in place, and from a vertebra supposed to belong to the same animal. First upper premolar very small, as in the Arboreal, Flying, and Ground Squirrels, with a similar conformation of the triturating surface. From Tertiary deposits, Henry's Fork, Wyoming.

## GENUS TILLOMYS Marsh.

*Tillomys* MARSH, Amer. Journ. Sci. and Arts, 3d ser. iv, 1872, 219.

Two species, differing mainly in size, are referred to this genus, described from very unsatisfactory fragments of lower jaws. Very little is known respecting the characters of the group.

## TILLOMYS SENEX Marsh.

*Tillomys senex* MARSH, Amer. Journ. Sci. and Arts, 3d ser. iv, 1872, 219.

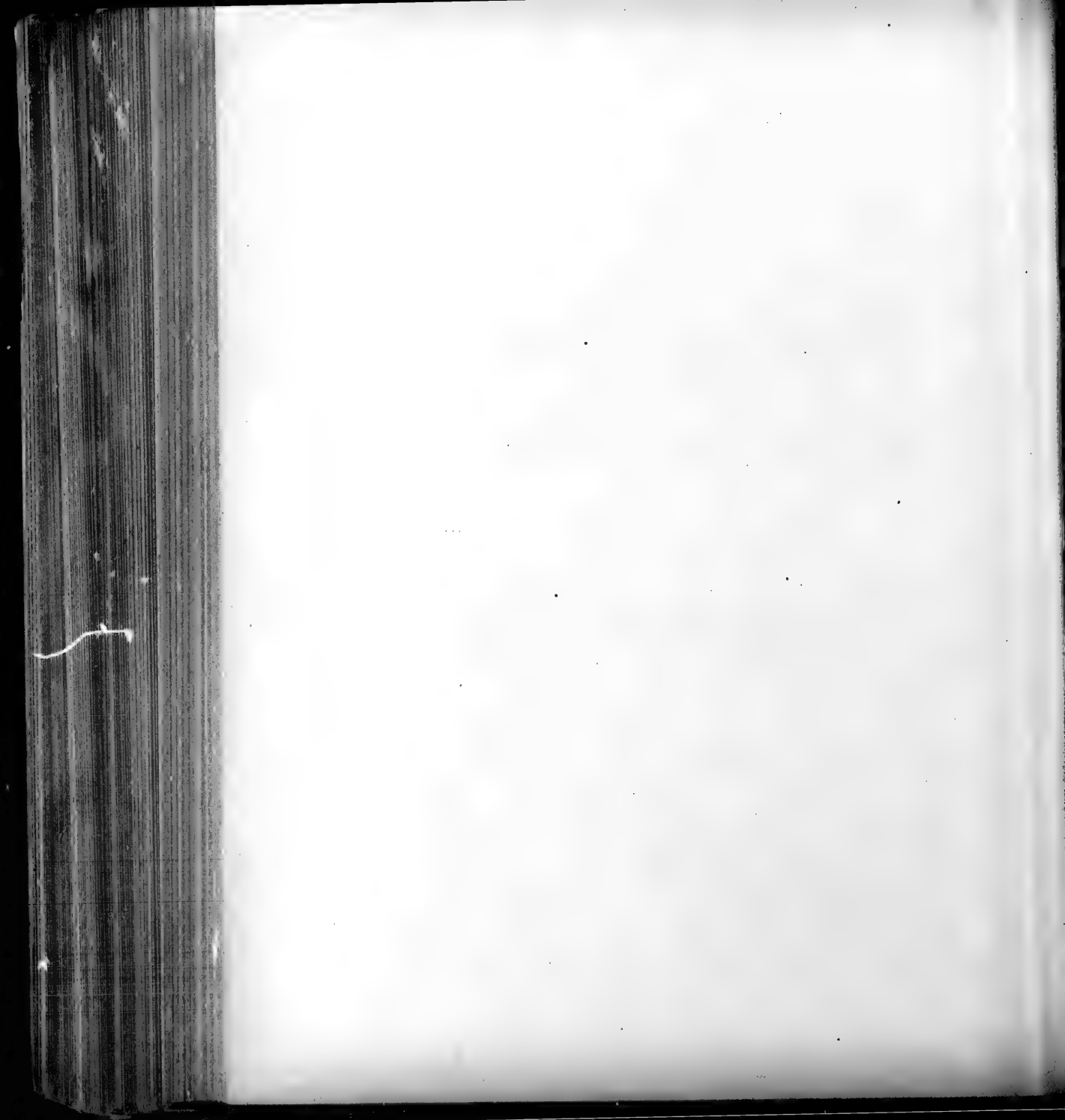
"About the size of a rat." Length of the lower molar series 11<sup>mm</sup>; depth of the lower jaw at the second molar 5<sup>mm</sup>. Described from a lower-jaw fragment, having the second molar in place. The jaw is described as

slender, with the tubercle at the anterior margin of the masseteric fossa under the centre of the second molar. The crown of the tooth has an anterior transverse crest and a pair of posterior tubercles. From the lower Tertiary deposits, Henry's Fork, Wyoming.

**TILLOMYS PARVUS Marsh.**

*Tillomys parvus* MARSH, Amer. Journ. Sci. and Arts, 3d ser. iv, 1872, 219.

Considerably smaller than the preceding. Length of lower molar series 7.1<sup>mm</sup>. Described from a similar imperfect lower-jaw fragment containing the second molar, from Grizzly Buttes, Wyoming.



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MONOGRAPHS  
OF  
NORTH AMERICAN RODENTIA.

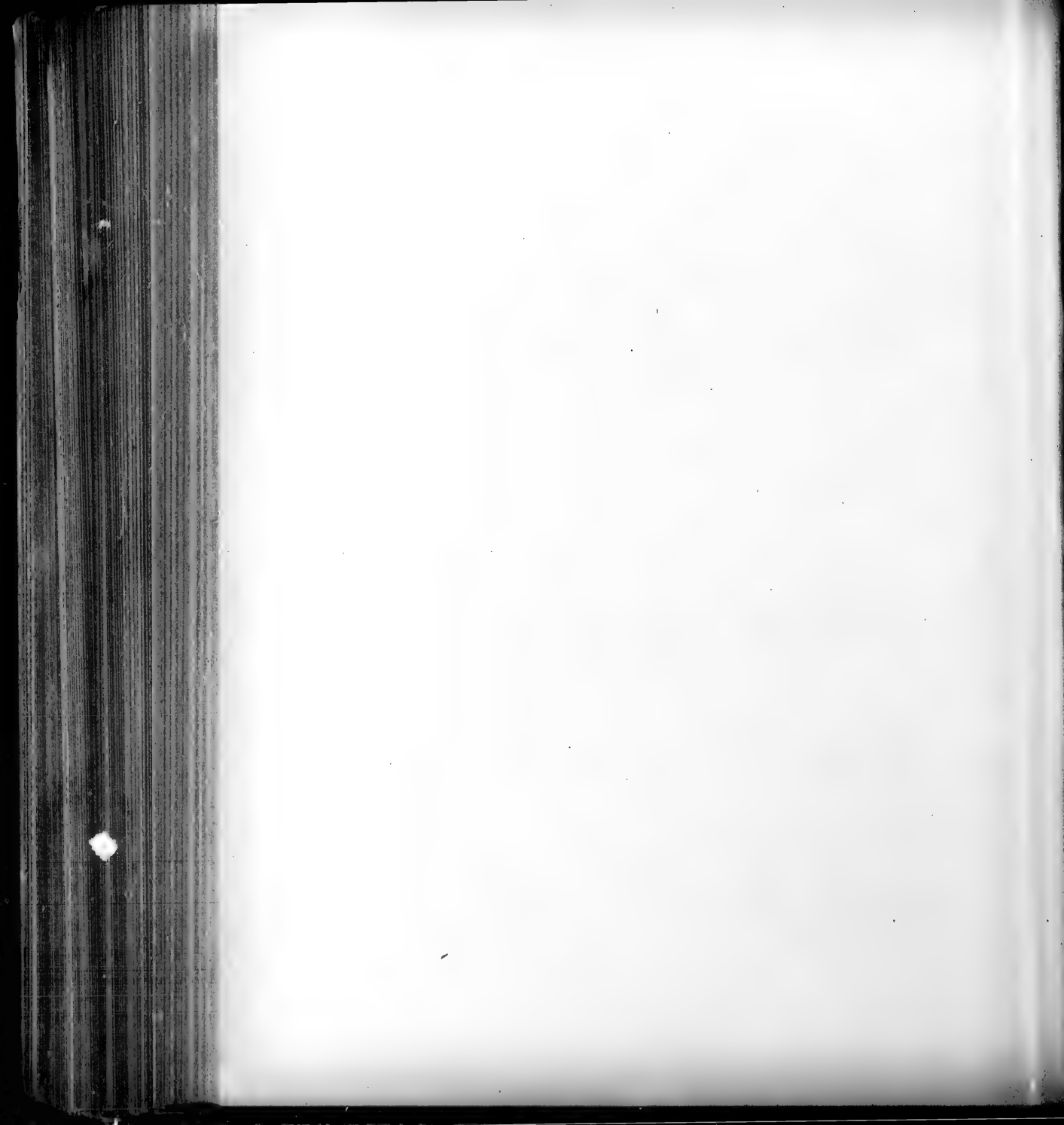
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No. XII.—APPENDICES.

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App. A.—By J. A. ALLEN.

App. B.—By T. GILL and E. COUES.



## APPENDIX A.

### SYNOPTICAL LIST OF THE EXTINCT RODENTIA OF NORTH AMERICA.

By J. A. ALLEN.

The following list is intended to include all of the extinct Rodentia of North America described prior to 1877. The Sciuriforms, Hystricomorphs, and Leporidae, having been nearly all noticed at some length in the preceding pages of the present series of monographs, it is deemed sufficient in the present connection to cite the earlier pages of the present work, wherein they are more fully noticed. In respect to the others, references are here given to the papers and works wherein they were originally described or subsequently noticed, together with short notices of their leading characteristics so far as they are at present known. With our present imperfect knowledge of the extinct forms here enumerated, it is impracticable to attempt anything more than a compilation of the species as described by authors.

#### GLIRES SIMPLICIDENTATI.

##### SCIUROMORPHA.

##### SCIURIDÆ.

- SCIURUS CALYCINUS Cope. See *anted*, p. 931.  
SCIURUS PANOLIUS Cope. See *anted*, p. 932.  
SCIURUS RELICTUS Cope. See *anted*, p. 932.  
TAMIAS LEVIDENS Cope. See *anted*, p. 932.  
ARCTOMYS VETUS Marsh. See *anted*, p. 933.  
PARAMYS ROBUSTUS Marsh. See *anted*, p. 934.  
PARAMYS LEPTODUS Cope. See *anted*, p. 934.  
PARAMYS DELICATUS Leidy. See *anted*, p. 934.  
PARAMYS DELICATIOR Leidy. See *anted*, n. 934.  
PARAMYS DELICATISSIMUS Leidy. See *anted*, p. 935.

SCIURAVUS NITIDUS Marsh. See *antè*, p. 935.

SCIURAVUS UNDANS Marsh. See *antè*, p. 935.

SCIURAVUS PARVIDENS Marsh. See *antè*, p. 936.

†SCIURAVUS — Leidy. See *antè*, p. 936.

#### *Incertæ sedis.*

HELISCOMYS VETUS Cope. See *antè*, p. 936.

MYSOPS FRATERNUS Leidy. See *antè*, p. 937.

MYSOPS MINUTUS Leidy. See *antè*, p. 937.

COLONYMYS CELER Marsh. See *antè*, p. 938.

TAXYMYS LUCARIS Marsh. See *antè*, p. 938.

TILLOMYS SENEX Marsh. See *antè*, p. 938.

TILLOMYS PARVUS Marsh. See *antè*, p. 938.

### CASTORIDÆ.

EUCASTOR TORTUS Leidy. See *antè*, p. 451.

STENEFIBER NEBRASCENSIS Leidy. See *antè*, p. 453.

STENEFIBER PANSUS Cope. See *antè*, p. 455.

### ISCHYROMYIDÆ.

The family *Ischyromyidæ* was recently proposed by Mr. E. B. Alston\* for the reception of Dr. Leidy's genus *Ischyromys*. Mr. Alston's diagnosis of the group, based on Dr. Leidy's figures and descriptions of his *Ischyromys typus*, is as follows:—"Dentition as in *Sciuridæ*. Skull resembling *Castoridæ*, but with the infraorbital opening large, a sagittal crest, no postorbital processes, palate broad, basioccipital keeled".†

#### GENUS ISCHYROMYS Leidy.

*Ischyromys* LEIDY, Proc. Acad. Nat. Sci. Phila. 1860, 89.

ISCHYROMYS TYPUS Leidy.

*Ischyromys typus* LEIDY, Proc. Acad. Nat. Sci. Phila. 1860, 89; 1867, 89; Journ. Acad. Nat. Sci. Phila. 2d ser. vii, 1869, 335, 405, pl. xxvi, figs. 1-6.

About the size of a Muskrat (*Fiber sibiricus*). Form of the skull somewhat resembling that of the Beaver (*Castor fiber*), but the interparietal region is greatly narrowed, more even than in the Muskrat, with the frontal relatively wider. The infraorbital opening was apparently as large as in the Muskrat. Upper grinding teeth five, "constructed after the plan of those of the Squirrel family".

The lower grinders, four in number, also resemble those of the *Sciuridæ*, and the lower jaw fragments are described as resembling the corresponding portions of the jaw of a Squirrel; "but the impression of the masseter is comparatively feeble, and only reaches as far forward as the position of the back part of the second molar tooth".

\* Proc. Zool. Soc. Lond. 1876, 78.

† Mr. Alston adds in a foot-note:—"It seems probable that *Pseudomys* Cope [= *Pseudotomus* Cope] (Proc. Amer. Phil. Soc. 1872, 467), from the Eccene of North America, may belong to this family." (ALSTON, l. c.)

The species was described from the greater portion of a skull and several fragments of lower jaws, discovered by Dr. Hayden in the Mauvaises Terres of Bear Creek (a tributary of the Shesenne River) and White River, in beds of Miocene age.

The genus has been referred by Dr. Leidy and Professor Cope to the *Sciuridae*, but evidently pertains to a distinct family, as shown by the large infraorbital foramina, the absence of postorbital processes, the great interparietal constriction of the skull, etc.

*Incertæ sedis.\**

#### GENUS GYMNOPTYCHUS Cope.

*Gymnoptychus* COPE, Pal. Bull. no. 16, 1873, 5; Ann. Rep. U. S. Geol. Surv. Terr. for 1873 (1874), 476.

"The essential features are, dentition; I.  $\frac{1}{2}$ ; C.  $\frac{3}{8}$ ; M.  $\frac{4}{2}$ ; the molars with two crescents on the inner side above, each of which gives rise to a cross-ridge to the outer margin. In the mandibular series the crests and crescents have a reversed relation. No cementum." *Gymnoptychus chrysodon*, the first species referred to this genus by its describer, is said to have no postorbital processes. The skull is said to be broad and stout, but not depressed, with the muzzle broad and short, and "the front" (frontal region?) moderately contracted. While its dentition is somewhat Sciurine, the absence of postorbital processes renders its reference to the *Sciuridae* quite doubtful, although it has been thus referred by Professor Cope.† Several species of this genus have been described by Professor Cope from the "Tertiary of the Plains"; but their exact locality of occurrence is not indicated.‡

#### GYMNOPTYCHUS CHRYSODON Cope.

*Gymnoptychus chrysodon* COPE, Pal. Bull. no. 16, 1873, 5.

"First upper molar a single cone. Incisors quite compressed. First inferior molar a broad oblong, the cusps opposite, the anterior close together. The two posterior cross crests do not form a V, the anterior being interrupted at the cusp. There is a delicate tubercle between the outer cusps of the three last molars. The incisor is compressed, the anterior and outer faces being separated by an angle."

#### GYMNOPTYCHUS NASUTUS Cope.

*Gymnoptychus nasutus* COPE, Pal. Bull. no. 16, 1873, 6.

Muzzle much compressed; nasal bones flat, extending beyond the upper incisors. Much smaller than the last, with the first molar narrower. Inferior molars with two cross-crests and two cingulae from the exterior cones, each posterior crest terminating in an interior cone.

#### GYMNOPTYCHUS TRILOPHUS Cope.

*Gymnoptychus trilophus* COPE, Pal. Bull. no. 16, 1873, 6; Ann. Rep. U. S. Geol. Surv. Terr. for 1873 (1874), 476.

Intermediate in size between the two preceding. Molars with two cross-crests, not connected by cingula.

#### GYMNOPTYCHUS MINUTUS Cope.

*Gymnoptychus minutus* COPE, Pal. Bull. no. 16, 1873, 6; Ann. Rep. U. S. Geol. Surv. Terr. for 1873 (1874), 476.

Very small, scarcely larger than a House Mouse (*Mus musculus*), and differs from the others somewhat in dentition.

\* The genera next following (*Gymnoptychus* and *Pseudotomus*) are evidently Sciuriforms, and may both be referable to the family *Ischyromyidae*.

† Ann. Rep. U. S. Geol. and Geog. Surv. Terr. for 1873 (1874), 474.

‡ Professor Cope, in his second notice of this genus (l. c.), says, "Two species are known, a larger and a smaller"; and then follow notices of *G. trilophus* and *G. minutus*, with no reference whatever to *G. chrysodon* and *G. nasutus*, described by him at the same time *G. trilophus* and *G. minutus* were described!



## GENUS PSEUDOTOMUS Cope.

*Pseudotomus* COPE, Proc. Amer. Phil. Soc. 1872, 467; U. S. Geol. Surv. Terr. 6th Ann. Rep. (for 1872), 1873, 610.

Skull depressed; zygomata considerably expanded; muzzle broad, but little elevated, with the nasal meatus between the alveoli of the upper incisors; frontals very short, the superciliary margin and orbits small, and without postorbital processes; temporal fossæ large, converging posteriorly, and greatly contracting the brain case behind the orbits; infraorbital foramen rather small, circular, and placed low down near the alveolar border; upper incisors relatively small, in form much as in *Arctomys*, but more widely separated; molars probably 3.

This genus was first referred by its describer to the order *Edentata*, but later was considered as "allied to, if not actually a member of, the *Sciuridæ*". The breadth and depression of the skull are said to remind one of *Arctomys*, from which, however, it differs in the contraction of the skull between the orbits, in this respect more resembling *Fiber*. It seems also in this and in other respects to strongly recall *Ischyromys*. The lateral separation of the incisors, both superior and inferior, is referred to as a marked peculiarity. Known from a single imperfect skull and one or two mandibular fragments from the Bad Lands of Cottonwood Creek.

## PSEUDOTOMUS HIANIS Cope.

*Pseudotomus hianis* COPE, Proc. Amer. Phil. Soc. 1872, 467; U. S. Geol. Surv. Terr. 6th Ann. Rep. (for 1872), 1873, 611.

The single imperfect skull from which the present species is known is said to indicate an animal of "about the size of an *Agouti*". From the Fort Bridger Eocene.

## MYOMORPHA.

## MURIDÆ.

## GENUS EUMYS Leidy.

*Eumys* LEIDY, Proc. Acad. Nat. Sci. Phila. 1856, 90.

## EUMYS ELEGANS Leidy.

*Eumys elegans* LEIDY, Proc. Acad. Nat. Sci. Phila. 1856, 90; 1867, 89; Journ. Acad. Nat. Sci. 2d ser. vii, 1869, 342, 407, pl. xxvi, figs. 12, 13.—COPE, Rep. U. S. Geol. and Geog. Surv. Terr. for 1873, 1874, 474.

The genus and species were described by Dr. Leidy from a specimen discovered by Dr. Hayden in the Bad Lands of Bear Creek, "consisting of a portion of the left side of a lower jaw". This jaw-fragment is said to indicate "an animal approaching in size the Brown Rat (*Mus decumanus*)", and to agree in form and constitution with the corresponding portion of the jaw of that animal.

## EUMYS LOXODON Cope.

*Hesperomys loxodon* COPE, Proc. Acad. Nat. Sci. Phila. 1874, 150.

*Eumys loxodon* COPE, Ann. Rep. Chf. Engineers, 1874, 605; ib. App. LL, 1.

Based on an entire mandibular ramus, with all the teeth preserved, from the Santa Fé marls. Similar to the *E. elegans* of Leidy.

NEOTOMA MAGISTER Baird. See *anted.*, p. 29

ARVICOLA (ISODELTA) SPEOTHEN Cope.

*Arvicola speothen* COPE, Proc. Amer. Phil. Soc. Phila. 1871, 87, fig. 13.

Described from "the entire dentition of the left ramus mandibuli, with a few fragments of the adjacent bone", from the Port Kennedy bone-cave, Pennsylvania. Anterior lower molar with one less triangle "than in any species of the section *Arvicola*", and hence regarded as representing a new subgeneric type.

ARVICOLA (PITYMYS) TETRADELTA Cope.

*Arvicola tetradelta* COPE, Proc. Amer. Phil. Soc. Phila. 1871, 88, fig. 14.

Described from a portion of the skull embracing the second and third upper molars. Differs from the other known North American *Arvicola* in the form of the enamel loops of the molars. Port Kennedy bone-caves, Pennsylvania.

ARVICOLA (PITYMYS) DIDEITA Cope.

*Arvicola dideita* COPE, Proc. Amer. Phil. Soc. Phila. 1871, 89, fig. 15.

Described from "the mandibular ramus of five and the superior dentition of probably three individuals", from the Port Kennedy bone-caves. Allied to *Arvicola (Pitymys) pinetorum*.

ARVICOLA INVOLUTA Cope.

*Arvicola involuta* COPE, Proc. Amer. Phil. Soc. Phila. 1871, 89, fig. 16.

"Established on a nearly complete ramus mandibuli, with the dentition perfectly preserved", from the Port Kennedy bone-caves. It is said to be "nearly allied to the *A. pinetorum*, differing principally in the form of the anterior lower molar". About the size of *A. riparius*.

ARVICOLA SIGMODUS Cope.

*Arvicola sigmodus* COPE, Proc. Amer. Phil. Soc. Phila. 1871, 90, fig. 17.

Based on "three imperfect mandibular rami, two with the dentition complete, the other with the posterior molar only wanting". About the size of *A. riparius*. Its characters are said to be near those of "*A. auctera*, Leach."

ARVICOLA (ANAPTOGONIA) HIATIDENS Cope.

*Arvicola hiatidens* COPE, Proc. Amer. Phil. Soc. Phila. 1871, 91, fig. 18.

Based on several molar teeth, which are several times larger than the corresponding teeth of any of the above-named species, "and suggest the genus *Fiber*". It is suggested that it may not be referable to either *Arvicola* or *Fiber*, and that it may require to stand as a separate genus. From the Port Kennedy bone-caves, Pennsylvania.

GEOMYIDÆ.

GEOMYS BISULCATUS Marsh.

*Geomys bisulcatus* MARSH, Amer. Journ. Sci. and Arts, 3d ser. ii, 1871, 121.

Apparently nearly allied to *Geomys bursarius*. From Pliocene strata, near Camp Thorne, Loup Fork, Northern Nebraska.

## GENUS COLOTAXIS Cope.

*Colotaxis* Cope, Pal. Bull. no. 15, 1873, 1.

"Inferior molars 3; crown plicate, with two connected cusps with crescentic section, on the outside, each of which gives rise to two transverse crests, which are unconnected. Of these crests, the anterior and posterior are marginal and less developed than the median pair. Intervals deep, without cement."

COLOTAXIS CRISTATUS Cope.

*Colotaxis cristatus* Cope, Pal. Bull. no. 15, 1873, 1.

"Anterior molar narrower than the others, the cusps partly alternating, the connecting crests of the exterior wall internally placed, the transverse crest from the posterior forming a V. Anterior cusps well separated. Enamel of all the molars smooth." Anterior face of incisors regularly convex. From the "Tertiaries of the Plains".

## HYSTRICOMORPHA.

## HYSTRICIDÆ.

HYSTRIX VENUSTUS Leidy. See *anted*, p. 397.

ERETHIZON CLOACINUM Cope. See *anted*, p. 398.

## CASTOROIDIDÆ.

CASTOROIDES OHIENSIS Foster. See *anted*, p. 494.

*Incertæ sedis.*

## GENUS AMBLYRHIZA Cope.

*Amblyrhiza* Cope, Proc. Acad. Nat. Sci. Phila. 1866, 313. See also *anted*, p. 421.

AMBLYRHIZA INUNDATA Cope.

*Amblyrhiza inundata* Cope, Proc. Acad. Nat. Sci. Phila. 1866, 313; Proc. Amer. Phil. Soc. Phila. 1869, 183, pl. iv, pl. v, fig. 1.

## GENUS LOXOMYLUS Cope.

*Loxomylus* Cope, Proc. Amer. Phil. Soc. Phila. 1869, 186. (See also *anted*, p. 421.)

LOXOMYLUS LONGIDENS Cope.

*Loxomylus longidens* Cope, Proc. Amer. Phil. Soc. Phila. 1869, 187, pl. v, figs. 2, 3.

LOXOMYLUS LATIDENS Cope.

*Loxomylus latidens* Cope, Proc. Amer. Phil. Soc. Phila. 1870, 608.

As already noted on a previous page of this work (p. 421), the genera *Amblyrhiza* and *Loxomylus*, together with the species referred to them, were based by Professor Cope (*l. c.*) on detached teeth from the bone breccia of caves, from Anguilla Island, West Indies, and are as yet too imperfectly known to render their affinities fully apparent. In the structure of the teeth, they are allied to the *Chinchillidæ*, and also to *Castoroididæ*, nearly equalling the latter in size, to which group they may prove to be referable,

HYDROCHÆRIDÆ.

HYDROCHÆRUS ÆSOPI Leidy.

*Oromys æsopi* LEIDY, Proc. Acad. Nat. Sci. Phila. 1853, 241.

*Hydrocharus æsopi* LEIDY, Proc. Acad. Nat. Sci. Phila. 1856, 165; Holmes's Post-pliocene Fossils of South Carolina, 1860, 112, pl. xxi, figs. 3-5; Journ. Acad. Nat. Sci. Phila. 2d ser. vii, 1869, 407.

Described from teeth found in the Post-pliocene deposit of the Ashley River, near Charleston, South Carolina.

GLIRES DUPLICIDENTATI.

LEPORIDÆ.

PALÆOLAGUS HAYDENI Leidy. See *anted*, p. 373.

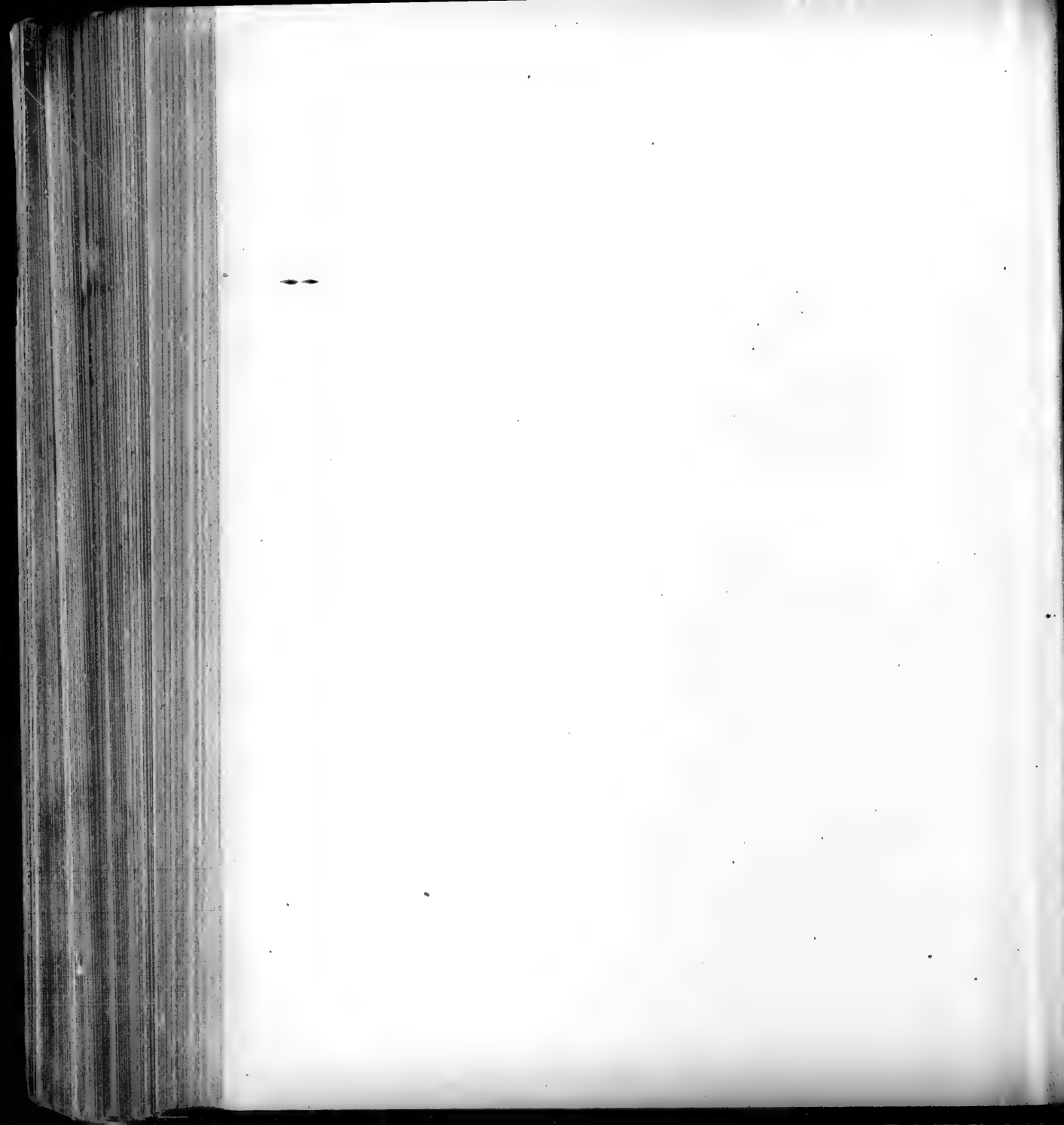
PALÆOLAGUS AGAPETILLUS Cope. See *anted*, p. 375.

PALÆOLAGUS TURGIDUS Cope. See *anted*, p. 375.

PALÆOLAGUS TRIPLEX Cope. See *anted*, p. 375.

PANOLAX SANCTÆFIDEI Cope. See *anted*, p. 376.

PRAOTHERIUM PALATINUM Cope. See *anted*, p. 377.



## APPENDIX B.

### MATERIAL

FOR A

## BIBLIOGRAPHY OF NORTH AMERICAN MAMMALS.

PREPARED BY THEODORE GILL AND ELLIOTT COUES.

Several years have passed since a Bibliography of North American Mammals was begun by Dr. Gill, and continued with the cooperation of Dr. Coues. The design was to make it as complete as could be reasonably expected, and to include (a) all works and papers on Mammalia at large published in North America, (b) all works and papers, wherever published, relating to North American Mammals, and (c) such general works or collateral special papers as bear more or less directly upon the subject. Pressure of other engagements upon each of the authors, however, obliged them to suspend the work in 1874, and the material now published represents simply the progress they had made at that date toward the completion of their plan. The Bibliography is therefore not supposed to be brought beyond 1874, when systematic compilation of titles was abandoned, although a number of titles of later date have been collated by one of the authors during his preparation of the index-slips for the press. In the fullest sense of the term, this compilation is only "material" for a Bibliography; the compilers are fully cognizant of its defects, and no criticism could be more severe than that which they themselves would pass upon it. But even in its present state, the Bibliography is much more extensive than any hitherto prepared; it is published in connection with these Monographs of by far the largest order of Mammalia, that the material which it represents may at length become available for all those who are working upon North American Mammalogy; and it is believed that it will be very useful to all who duly regard the purport of this explanatory note.

The titles are arranged in chronological order under a few heads. The first set consists of general and miscellaneous publications on Mammals at large; the second of faunal publications, or those relating to the Mammals of particular geographical areas; while the remaining sets are those of orders or sub-orders of the Mammalia. The Bibliography of American publications is believed to be very nearly complete down to 1874 inclusive; in other respects, the work is very imperfect. Many of the titles, especially the foreign ones, are taken at second hand, and those which have not been verified may not be found to be literally correct. The titles of many of the general works are not given in full.

A considerable part of the Bibliography—that relating to several of the families of the Rodentia—has already been presented on earlier pages of this volume, and such titles are not here duplicated.

In the labor of preparing this matter for the press, which has devolved upon Dr. Coues, much assistance has been rendered by Mr. Allen, who has kindly revised the proofs, adding some titles, and making many valuable suggestions. Very great assistance has also been rendered by Mr. William Young, the accomplished proof-reader of the Government Printing Office, to whom special thanks are due for his valuable services in securing accurate typography, and in perfecting the arrangement of the titles.

## A.—GENERAL AND MISCELLANEOUS PUBLICATIONS.

- 1551.—**Geener, C.**—Conr. Geeneri historię animalium lib. I de quadrupedibus viviparis. Folio. Tiguri, 1551.
- 1669.—**Geener, C.**—Allgemeines Thierbuch, durch Conr. Geenerum in lateinischer Sprache beschrieben, durch Conr. Forerum ins Deutsche übersetzt. Folio. Frankf. 1669.
- 1693.—**Ray, J.** Synopsis methodica animalium quadrupedum et serpentini generis. Vulgarium notis characteristicis, rariorum descriptiones integras exhibens: cum historis & observationibus anatomicis perquam curiosis. Præmittuntur nonnulla de animalium in genere, sensu, generatione, divisione, &c. 8<sup>o</sup>. 8 p. l., 336 pp., with portrait opposite title. London: impensis S. Smith & R. Walford, 1693.
- 1704.—**Tyson, E.** A new division of terrestrial brute animals, particularly of those that have their feet formed like hands. < Philos. Trans. Roy. Soc. London, xxiv, 1704, pp. 1566-1673.
- 1734-65.—**Seba, A.** Locupletissimi rerum naturalium thesaurus accurata descriptio et iconibus artificiosissimis expressio, per universam physices historiam. 4 vols. Folio. 1734-65.
- 1735.—**Linnaeus, C.** Caroli Linnaei, Sveci, Doctoris Medicinæ, Systema naturæ, sive regna tria naturæ systematice disposita per classes, ordines, genera & species. O Jehova! quam ampla sunt opera Tua! Quam ea omnia sapienter fecisti! Quam plena est terra possessione Tua! *Psalm.* civ. 24. Lugduni Batavorum, apud Theodorum Haak, 1735. Ex typographia Joannis Wilhelmi de Groot. Folio. 7 l. unnumbered and unpagged.

[The only copy of the original edition the existence of which in the United States is known to us is in the library of J. Carson Brevoort, esq., of Brooklyn. The 3d ed., published in Latin and German, by J. J. Lange, at Halle, in 1740, is a reprint of the first. (See beyond for the other editions, under their respective dates.) A textual reprint of the first edition was also published in 8<sup>o</sup>, at Paris, in 1830, by Fée, p. v.]

## ANALYSIS.

- I. QUADRUPEDIA:—33 genera.  
 I. *Anthropomorpha*.—Homo, Simia, Bradypus, 3.  
 II. *Fera*.—Ursus, Leo, Tigris, Felis, Mustela, Didelphis, Lutra, Odobenus, Phoca, Hyæna, Canis, Meles, Talpa, Erinaceus, Vespertilio, 15.  
 III. *Glires*.—Hystrix, Sciurus, Castor, Mus, Lepus, Sorex, 6.  
 IV. *Jumenta*.—Equus, Hippotamus, Elephas, Sus, 4.  
 V. *Pecora*.—Camelus, Cervus, Capra, Ovis, Bos, 5.
- 1740.—**Linnaeus, C.**—Caroli Linnaei Naturæ Curiosorum Dioscoridis Secundi Systema naturæ in quo naturæ regna tria, secundum [!] Classes, ordines, genera, species, systematico pronuntur. Editio secunda, auctior. Stockholmæ, apud Gottfr. Kiesewetter, 1740. 8<sup>o</sup>. 2 p. l., 80 pp.
- [The 5th ed. is a reprint of the 3d, and was published by M. G. Agesthler, at Halle, in 1747 (8<sup>o</sup>, 68 pp.). It contains the German names.]

## ANALYSIS.

- I. QUADRUPEDIA:—32 genera.  
 I. *Anthropomorpha*.—Homo, Simia, Bradypus, Myrmecophaga [not in 1st ed.], 4.  
 II. *Fera*.—Ursus, Leo, Tigris, Felis, Mustela, Didelphis, Lutra, Phoca, Canis, Meles, Erinaceus, Talpa, Vespertilio, 13. [Odobenus and Hyæna suppressed.]  
 III. *Glires*.—Hystrix, Lepus, Sciurus, Castor, Mus, 5. [Sorex removed to Jumenta.]  
 IV. *Jumenta*.—Elephas, Hippopotamus, Sorex?, Equus, Sus, 5.  
 V. *Pecora*.—Camelus, Cervus, Capra, Ovis, Bos, 5.  
 [Two genera suppressed; one added.]
- 1743.—**Klein, J. T.** Summa dubiorum circa classes quadrupedum et amphibiorum in celeberrimo domini Caroli Linnaei systemate naturæ; sive naturalis quadrupedum historię promovende prodromus cum præludio de crustatis. Adjecti discursus: I. De ruminantibus. II. De periodo vitæ humanæ collato cum brutis. Gedani et Lipsiæ, 1743. Gleditsch. 4<sup>o</sup>. 52 pp., 2 pl.
- 1743-51.—**Edwards, G.** A natural history of uncommon birds and of some other rare and undescribed animals. . . . In 4 parts. 4<sup>o</sup>. London, 1743-51.
- [Pt. I, pl. 1-58; pt. II, pl. 53-105; pt. III, pl. 106-157; pt. IV, pl. 158-211.—French transl., 1745.]

- 1744.—**Linnaeus, C.** Caroli Linnæi Medic. & Botan. in Acad. Upsaliensi Professoris Acad. Imperialis, Upsaliensis, Stockholmensis & Monspeliensis Soc. *Systema naturæ* in quo proponuntur naturæ regni tria secundum classes, ordines, genera & species. Editio quarta ab auctore emendata & aucta. Accesserunt nomina Gallica. Parisiis, sumptibus Michaelis-Antonii David, bibliopole, via Jacobæ, sub signo Calami aurei, 1744. Cum privilegio regis. 8°. 3 p. l. [*Fundamenta Botanica*], xxvii, [1], 168 pp., tab.
- [This is said, by Linæ. to have been edited by B. Jussieu, and to be the same as the 9d ed. ("per B. Jussieu. Adjecta nomina Gallica. idem cum 9°"). It contains, however, in addition to the "*Fundamenta Botanica*", a special introduction (by himself), which concludes with the remark that it is the 4th ed., revised and enlarged (sem quartam castigatam iterum auctamque Lectori offere Benevolo.—p. 3).]
- 1747.—**Linnaeus, C.** . . . *Systema naturæ*. . . 8°. 88 pp. Halle, M. G. Agnethler, 1747.
- [The 5th ed., a reprint of the 3d, with the German names. Mamm. pp. 43-51. The genera are exactly the same as in the 9d ed., but spelled with *w* instead of *u*. See under 1740.]
- 1748.—**Linnaeus, C.** Caroli Linnæi Archiatr. Reg. Med. et Bot. Prof. Upsal. *Systema naturæ sistens regna tria naturæ, in classes et ordines genera et species reducta tabulicis auctis illustrata*. Cum privilegio S. R. M. Svecicæ & S. R. M. Polonicæ ac Electoris Saxon. Editio sexta, emendata et aucta. Stockholmæ, impensis Godofr. Klesowetteri, 1748. 8°. iv, 224 pp., 2 p. l., 14 l., 7 pl.
- [The 5th ed., published at Leipzig (Lipsia) in 1748, is a textual reprint of the 6th (secundum sextam) Stockholmensem emendatam & auctam editionem, by the same publisher, but with the German popular names instead of Swedish. The 8th ed. contains the vegetable kingdom only.]
- 1751.—**Klein, J. T.** Jacobi Theodori Klein . . . *quadrupedum dispositio brevique historia naturalis*. Lipsiæ, apud Ionam Schmidt, bibl. Lvbec, 1751. 4°. 2 p. l., 127+1 pp., 5 pl. folded.
- Steller, G. W.** De bestiis marinis. < Nov. Comment. Acad. Petropol. ii, 1749 (1751), pp. 280-288, 3 pl.
- 1752.—**Anon.** Schauplatz (Systematischer) aller einheimischen und ausländischen vierfüssigen Thiere. Nürnberg, 1752.
- Hill, J.** An history of animals. Folio. London, 1752.
- 1754.—**Brisson, M. J.** *Système naturel du règne animal, par classes, familles ou ordres, genres et espèces. Avec une notice de tous les animaux; les noms grecs, latins & vulgaires, que les naturalistes leur ont donnés; les citations des auteurs qui en ont écrit; une table pour chaque classe, qui désigne la famille ou l'ordre, le genre & l'espèce, de chaque animal. Ouvrage enrichi de figures en taille douce. Suivant la méthode de Klein; avec une notice de celle de M. Linnæus, et l'ordre des poissons, suivant la division d'Artedi et l'ordre des oursins de mer. Trad. de l'Allem. par Math. Jacq. Brisson.* 8°. Bauche, Paris, 1754.
- Klein, J. T.** Doutes ou observations de Mr. Klein . . . sur la revue des animaux, faite par le premier homme, sur quelques animaux des classes des quadrupèdes & amphibies du système de la nature de M. Linnæus. Et des remarques sur les crustacées, sur les animaux qui ruminent, & sur la vie de l'homme, comparée avec celle des animaux. Avec figures. Ouvrage traduit du Latin . . . [par Fr. Al. Aubert de Lachèze de Bois]. 8°. 2 p. l., 108 pp., 1 pl. folded. À Paris, . . . chez Cl. J. B. Bauche, . . . 1754.
- Linnaeus, C.** *Museum S. R. M. Adolphi Friderici, Regis Suecorum* . . . Folio. Stockholm, 1754.
- 1755.—**Johnston, J.** *Theatrum universale omnium animalium quadrupedum*. Folio. Heilbr., 1755.
- 1756.—**Brisson, M. J.** *Regnum animale in classes IX distributum, sive synopsis methodica sistens generalem animalium distributionem in classes IX, & duarum primarum classium, quadrupedum scilicet & cetaceorum, particularem divisionem in ordines, sectiones, genera et species. Cum brevi cujusque speciei descriptione, citationibus auctorum de his tractantium, nominibus eis ab ipsis & nationibus impositis, nominibusque vulgaribus. . . Cum figuris æneis.* Parisiis, ad Bipam Augustinorum, apud Cl. Joannem-Baptistam Bauche, . . . 1756. . . . [Or]
- Brisson, M. J.** Le règne animal divisé en IX classes, ou méthode contenant la division générale des animaux en IX classes, & la division particulière des deux premières classes, savoir de celle des quadrupèdes & de celle des océacées, en ordres, sections, genres & espèces. Auxquelles on a joint une courte description de chaque espèce, avec les citations des auteurs qui en ont traité, les noms qu'ils leur ont donnés, ceux que leurs ont donnés les différentes nations, & les noms vulgaires. . . . Avec figures en taille douce. À Paris, Quay des Augustins, chez Cl. Jean Baptiste Bauche, 1756. vi, 382 pp., 1 l., 2 tab., 1 pl.



- 1756.—**Linnaeus, C.** . . . . *Systema naturae sistens regna tria naturae in classes et ordines genera et species reductae tabulisque aeneis illustrata. Accedunt vocabula Gallica. Editio multo auctorior & emendatior. Lugduni Batavorum, apud Theodorum Haak, 1756. 8°. 4 p. l., 227 [+1] pp., [index] 9 l., 8 pl., with 4 l. explan.*

[This edition is recognised by Linné as the 9th, and said to have been edited by Gronovius, and to be the same as the 6th, with very few additions respecting the birds and fishes. ("Per Gronovium. Fasciculus de Avibus, Piscibus, idem cum 6.")]

## ANALYSIS.

- I. QUADRUPELIA [pp. 2-15]:—34 genera.  
 I. *Anthropomorpha*.—Homo, 1 sp.; Simia, 16 spp.; Bradypus, 2 spp. [3 genera].  
 II. *Ferae*.—Ursus 2, Felis 8, Mustela 9, Lutra 2, Canis 7, Phoca 2, Meles 3, Erinaceus 2, Dasy-  
 pus 7, Talpa 2, Vespertilio 5 [11 genera].  
 III. Ord. *Agriae* [not in eda. 1-v].—Myrmecophaga 3, Maus 1 [2 genera].  
 IV. *Glires*.—Hystrix 4, Sciurus 3, Lepus 4, Castor 3, Mus 11, Sorex 1, Didelphis 2 [7 genera].  
 V. *Jumenta*.—Elephas 1, Rhinoceros 2, Hippopotamus 1, Equus 3, Sus 4 [5 genera].  
 VI. *Pecora*.—Camelus 21, Moschus 1, Cervus 6, Capra 11, Ovis 3, Bos 4 [6 genera].

- 1757.—**Hallen, J. S.** *Die Naturgeschichte der Thiere in systematischer Ordnung. Die vierfüßigen Thiere.* Von Joh. Sam. Haller [Hallen]. 8°. Berlin, 1757.

- 1758-59.—**Linnaeus, C.** *Caroli Linnaei Equitis De Stelli Polari, Archiatri Regii, Med. et Botan. Profess. Upsal.; Holmens. Petropol. Berol. Imper. Lond. Monspel. Tolos. Florent. Soc. Systema naturae per regna tria naturae, secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis. Editio decima, reformata. Cum privilegio Sae. Ruae Mitis Sueciae. Holmiae, impensis Direct. Laurentii Salvii, 1758-59. 2 vols. 8°.*

Tomus I. Regnum animale. 2 p. l., pp. 1-824. 1758.

Tomus II. Regnum vegetabile. 2 p. l., pp. 825-1384. 1759.

[In this edition, the binomial system previously employed by him in the work entitled *Museum Tensinianum* (1753), was extended in its application to all the kingdoms of nature; the Ardeian classification of fishes, adopted in the earlier editions, was superseded by the familiar Linnaean system, and the cetaceans were for the first time eliminated from the class of fishes and grouped with the viviparous quadrupeds under the new class name *Mammalia*. This edition was reproduced at Halle (Halle Magdeburgensis, typis et sumptibus Jo. Jac. Cuvr. 1760), in an exact reprint (Frankfurt est. Joannes Josephus Langius), in 1760, but has not been acknowledged as one of the so-called editions. The recognised 11th edition was published at Leipzig in 1766, and is also a reprint of the 10th, but was condemned by Linné ("Furtim prodit vitiosum. Nil additum").]

- 1758-64.—**Edwards, G.** *Gleanings of natural history.* 4°. London, 1758-64.

- 1759.—**Aron.** *Dictionnaire raisonné et universel des animaux.* Par M. D. L. C. D. B. 4°. Paris, 1759.

- 1760.—**Klein, J. T.** *Klassifikation und kurze Geschichte der vierfüßigen Thiere, aus dem Lateinischen übersetzt und mit Zusätzen vermehret, nebst einer Vorrede von Friedrich Daniel Behn, . . . Lübeck, bey Jonas Schmidt, 1760. 8°. 36 + [7] pp., 1 l., 5 pl.*

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In conclusion, it may be said that the original editions recognised by Linné as completely revised ones were the 1st (1753), the 3d (1740), the 6th (1748), the 10th (1758), and the 12th (1766-68).

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The second was reprinted at Paris in 1744 (with modifications), as the 4th edition; and at Halle in 1747, and the reissue was subsequently recognised as the 5th edition.

The 6th edition was reissued at Leipzig, and subsequently known as the 7th; and closely followed in the edition of Leipzig, recognised as the 9th.

The 8th edition did not contain the Animal Kingdom.

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Sechster Theil. | Umfassend die sechste und siebente Abtheilung, oder die Ein- und Vierhufer. | Das Pferd. Der Elephant. Das Nashorn. Das Flusspferd. Der Tapir. Das Schwein. | — | Nebst Tafel 308 bis 338. | — | Erlangen, | in der Expedition des Schreber'schen Säugethier- und des Esper'schen Schmetterlingswerkes, | und in Commission der Palm'schen Verlagsbuchhandlung, | 1838. [pp. i-xvi (incl. title), 1-520, tab. 308-338 + 316 A, 317 A, 317 B, 317 C, 317 D, 317 E, 317 F, 317 G, 317 H, 319 A, 319 B, 324 A, 325 A, 326 B, 325 B (bis), 326 A.]

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[The number of species described in the preceding volumes, according to Wagner (vol. 7, p. v), is 1446, viz:

Affen.....	128	Nager.....	446	Ruderfüsser.....	90
Flederthiere.....	944	Zahnwücher.....	30	Fischsitzthiere.....	48
Insektenfresser.....	65	Einhufer.....	6		
Fleischfresser.....	206	Dickhäuter.....	57	Im Ganzen.....	1446
Beuteltiere.....	87	Wiederkäuer.....	145		

The original work was published in fasciculi, and the dates on the titles are apparently those of the completion of each Theil. Thus, it appears by contemporary evidence, that the first portion of Theil III was published several years prior to the date on the title-page, and such is doubtless the case with other portions of the work See, also, 1640.—WAGNER, J. A. The Supplementband, erste Abth. (pp. vi, vi, 531), contains the quadrumana and chiroptera, and dates 1840; zweite Abth. (pp. viii, 558), carnivora, dates 1841; dritte Abth. (pp. xiv, 614), marsupialia and part of the rodents, 1843; vierte Abth. (pp. xii, 565), the rest of the rodents, the edentata, ruminants, etc., 1844. There is a fifth part or volume, date 1855, q. v.]

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[The classification adopted in this article is as follows:—

CLASSIS I.—*Mammalia.*

SUBCLASSIS I.—*Quadrupeda.*

SECTIO I.—*Ungulata.*

Ordo Primates.

Chiroptera.

Feræ (subdivided into the orders Bestiæ [= Insectivora ambulatoria] and Feræ in 1833).

Marsupialia.

Glires.

Bruta.

SECTIO 2.—*Ungulata.*

Ordo Pecora.

Belluæ.

SUBCLASSIS II.—*Bipeda.*

Ordo Cete (subdivided into the orders Sirenia—which succeed Bruta—and Hydranta in 1833).

CLASSIS II.—*Menstruata.*

Ordo Tachyglossa.

Platyptoda.]

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- [After the diagnosis of the branch ("provincia") follow "Classium distinctio" (p. 106), "Classis i, Mammalia" (diagnosis, p. 108); "Ordinum distributio" (with diagnosis, pp. 107-119); and, lastly, "Index familiarum et subfamiliarum" (pp. 111-119). A like sequence is adopted for the other classes (Aves, Amphibia, and Plesces). The mammals are divided into 41 families and 75 subfamilies, monotypic families being represented by subfamilies of equal extent.]
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- 1839.—Bachman, J.** Observations on the changes of colour in birds and quadrupeds. < *Trans. Am. Philos. Soc. Phila.* vi, 1839, art. iv, pp. 197-239.
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- [The diagnoses of the orders and including groups are repeated from the earlier article (1838), but intercalated therewith, and forming an unbroken series, are the diagnoses of the families and subfamilies, which are the same as those enumerated in the "Index familiarum et subfamiliarum" of the earlier article. The groups Placentalia and Infracentalia are, however, designated "series" instead of "subclasses", and the Edocabilia and Inedocabilia "subclasses" instead of "sections"; the subfamilies 15 and 16, 23 and 26, and 33 and 34, are severally reversed in position with respect to each other.]
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- Gray, J. E.** On some new or little known mammalia. < *Ann. Nat. Hist.* ii, 1839, pp. 284-287.

- 1839.—*Anon.* Histoire naturelle des animaux les plus remarquables de la classe des mammifères (quadrupèdes et cétacés); par un naturaliste du musée; ornée de soixante figures d'animaux, dessinées et gravées par C. Franc, peintre d'histoire naturelle. 19°. 2 p. l., viii, 232 pp., 12 pl. Paris, J. Samson, 1839.

[Recognizes "a new class of the Ornithodactyles" p. vii, and "Didelphes elenithodactyles" p. 213, et "D. syn-dactyles" p. 215, and adopts class. of Blainville p. vii.]

- 1839-57.—*Leuret, F. and Gratiolet, P.* Anatomie comparée du système nerveux considéré dans ses rapports avec l'intelligence. 3 vols. Paris, J.-B. Baillière et fils, 1839-57.

[Atlas de 36 planches dessinées d'après nature et gravées. Paris, J.-B. Baillière et fils, 1839-57. Folio, pp. 60 —, pl. 30.]

- 1839-64.—*Blainville, H. M. D. de.* Ostéographie ou description iconographique comparée du squelette et du système dentaire des mammifères récents et fossiles pour servir de base à la zoologie et à la géologie par H. M. Ducrotay de Blainville. . . . Ouvrage accompagné de 323 planches lithographiées sous sa direction par M. J. C. Werner, peintre du Muséum d'Histoire Naturelle de Paris, précédé d'une étude sur la vie et les travaux de M. de Blainville, par M. P. Picard. Text, 4°, 4 v.; atlas, fol., 4 v. Paris, J. B. Baillière et fils, 1839-64.

[Published in twenty-six fascicules; the first twenty-five under the title: "Ostéographie; ou, description iconographique comparée du squelette et du système dentaire des cinq classes d'animaux vertébrés récents et fossiles, pour servir de base à la zoologie et à la géologie par M. H. M. Ducrotay de Blainville. . . . Ouvrage accompagné de planches lithographiées sous sa direction par M. J. C. Werner. . . . Paris, Arthus Bertrand, . . . (1839-55). The twenty-sixth and last fascicule was issued with the special title above given, titles for the four volumes of text and four of plates, table of contents and index, by the Baillières, in 1864.

The culpable neglect of the publishers to give the dates of publication of the several fascicules has doubtless devolved upon many investigators, as upon the writer, much trouble and annoyance in ascertaining them, and to save to others similar trouble, a collation is here presented, the dates having chiefly been ascertained from Wagner's annual reports in the "Archiv für Naturgeschichte". The appearance of successive fascicules has not been noticed in the "Bibliographie de la France".

The titles of the respective monographs given below are those at the upper fourth of the first page of each monograph, and which are the only special titles published.

The work is more remarkable as a methodical repository of facts respecting superficial osteological details than as a digest exhibiting acute appreciation of the value and subordination of characters and their taxonomic application, or orthodox views respecting classification and the geological succession of animals—the concurrent views of the most recent and approved investigators being the standard. The "genera", it must be remembered, are generally about equal in extent to the families now generally adopted.]

## CONTENTS.

Tome premier | Primates—Secundates | Avec atlas de 59 planches. [7 pp. + 9 parts,\* as below:—]

Atlas—Tome premier | composé de 59 planches | Primates—Secundates. [3 p. l. + 5 parts, viz:—]

[A title-page with the more general title (see above) and the addition "Mammifères—Tome premier" was issued with the first fascicule in "1839", and another with the modification "Mammifères—Primates: Pithecia. Cebus. Lemur." in "1841", but both are superseded by the special title issued for the first volume with the twenty-sixth fascicule.]

[Étude sur la vie et les travaux de M. de Blainville, par M. P. Nicard.] (1864.—cxxxiii. pp. < F. xxvii.]

[A.] De l'ostéographie en général. < Ostéographie des mammifères, pp. 19-47. [1839.—47 pp. < F. i.]

[B.] Ostéographie des Primates.—Sur les primates en général et sur les singes (*Pithecia*) en particulier. [1839.—54 pp. 11 pl. < F. l. (+ pl. 1 bis and 5 bis. < F. xiv, 1855.)]

[A secondary general title for the Primates was issued as the first pages (p. 1-1. 1) of the preceding, viz: "Ostéographie des mammifères de l'ordre des Primates, suivie de recherches sur l'histoire de la science à leur égard, les principes de leur classification, leur distribution géographique actuelle et leur ancienneté à la surface de la terre."]

[C.] Ostéographie des Primates.—Sapajous (*Cebus*). [1839.—31 pp. 9 pl.—F. ii.]

[D.] Ostéographie des Primates.—Makis (*Lemur*). [1839.—48 pp. 11 pl. < F. iii.]

[E.] Mémoire sur la véritable place de l'Aye-Aye dans la série des mammifères. Lu à la Société philomathique, le 16 mai 1816. [1839.—40 pp. < F. iii.—Plate < F. iii.—Plate—pl. 5 < D.]

[F.] De l'ancienneté des Primates à la surface de la terre. 68 pp. [1839.] < F. iv.—Sans planches.]

[G.] Ostéographie des Chéloptères (*Vesperugo*, L.). [1839.—104 pp. 15 pl. < F. v.]

[H.] Ostéographie des Mammifères insectivores (*Scalops*, *Boreas* et *Arctosaurus*, L.). [1840.—115 pp. 11 pl.—F. vi.]

Tome deuxième | Secundates | Avec atlas de 117 planches. [viii. pp. + 9 parts.]

Atlas—Tome deuxième | composé de 117 planches | Secundates. [3 p. l. + 8 parts, viz:—]

[I.] Ostéographie des Carnassiers. [1840.—53 pp. < F. vii.]

[A secondary title for the Carnassiers (I.—Q) was issued as the first pages (p. 1-1. 1) of the preceding, viz: "Ostéographie des Carnassiers, précédée de considérations sur l'histoire de la science à leur égard, les principes de leur classification, leur distribution géographique actuelle, et suivie de recherches sur leur ancienneté à la surface de la terre."]

[J.] Des Phoques (*G. Phoca*, L.). [1840.—31 pp. 10 pl. < F. vii.]

\* The "parts" in each monograph or series distinguished by a special and complete pagination or numeration of plates.

- (*K*) Des Ours (*G. Ursus*). [1841.—94 pp. 18 pl. = F. viii.]  
 (*L*) Des Petit-ours (*G. Suburus*). [1841.—123 pp. 16 pl. = F. ix. (+ pl. 17 < F. x, 1842.)]  
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 (*M*) Des Mustelas (*G. Mustela*, L.). [1842.—83 pp. 15 pl. = F. x.]  
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 (*O*) Des Felis. [1842.—196 pp. 1 folded tab. 10 pl. = F. xii. (+ pl. 20 < F. xxv., 1852).]  
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 (*X* and non-lettered.) Monographie du Cheval, *G. Equus*. 1864. [80 pp. < F. xxvi.]  
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 (*A.A.*) Sur les Hippopotames (Buffon), (*Hippopotamus*, L.) et les Cochons (Buffon), (*Sus*, L.). 1847.  
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 (*B.B.*) Des Anoplotheriums (*G. Cuvier*) et sur les genres plus ou moins différents:  
 1849. [155 pp. 9 pl. = F. xxiii.]  

Xiphodon, }	Merycopotamus, }	Falconer et Cateley, †
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Adapis, }	Palæotherium, }	
Chalcotherium, J. Kaup, 1833.	Dichodon, }	R. Owen, 1848
Cainotherium, Brard, 1835.	Hypotamias, }	

Microchoerus, Sc. | Wood, 1846.  
 (*CC*) Des Ruminants (*Potior*, L.) en général et en particulier des Chameaux, des Lamas, Buffon. (*G. Casua*, L.) 1850. [131 pp. 5 pl. = F. xxiv.]  
 (*DD*) Océographie des Paracenz (*Bradypus*, L.). [1840.—64 pp. 6 pl. = F. v.]  
 (*EE*) General title. Publication posthume.—Explication des planches suivantes.  
 PLIÈRES. Genres. Gorilla, Smilodon, Scirus, Arctomya, Castor, Capromya, Myopotamus, Hystrix, Cavia,  
 Equus, Camelopardalis, Myrmecophaga, Macrotherium, Megatherium, Glyptodon, Toxodon, Elasmotherium,  
 Macrauchenia et groupes qui s'y rattachent.  
 QUAMMIFÈRES. Genre Crocodilus et groupes génériques voisins.  
 OXYCÉPHALES. Signification des os du crâne dans les diverses classes de ce type. 1855. [63 pp. 41 pl.] Table  
 alphabétique des quatre volumes. 1855. [xvi pp. < F. xxvi.]

1840.—Blainville, H. M. D. de. Considérations générales sur les animaux et leur classification.  
 < Dict. Sci. Nat., Supplément, 1840.

1840-55.—Wagner, J. A. Die Säugethiere in Abbildungen nach der Natur, mit Beschreibungen. . .  
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 1ste-4te Abth., Erlangen, in der Expedition des Schreiber'schen Säugethier- und des Esper-  
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- Erste Abtheilung: Die Affen und Flederthiere. 1840. [xiv, (1), vi, 551 pp.]  
 Zweite Abtheilung: Die Raubthiere. 1841. [viii, 658 pp.]  
 Dritte Abtheilung: Die Beutethiere und Nager (erster Abschnitt). 1843. [xiv, 614 pp.]  
 Vierte Abtheilung: Die Nager (zweiter Abschnitt), Zahnlicker, Einhufer, Dickhäuter und  
 Wiederkäuer. 1844. [xii, 523 pp.]  
 Fünfte Abtheilung: Die Affen, Zahnlicker, Beutethiere, Huftiere, Insektenfresser und  
 Handflügler. 1855. [xxvi, 810 pp.]

\*The first series of letters is given in the list of monographs opposite title-pages, and the second in the table of con-  
 tents of the 3d volume.

†The osteography of the original is copied.

- 1841.—**Bonaparte, C. L.** A new systematic arrangement of vertebrated animals. <Traus. Linn. Soc. London, xviii, 1841, pp. 247-304 (Clasas i, Mammalia, pp. 247-258).  
[In sequence, this is essentially similar to the "Synopsis vertebratorum systematis", but a "Conspectus familiarum et subfamiliarum", with diagnoses of the groups, replaces the "Index". As in the last, the groups Placentalia and Implacentalia are designated "series" and the Educabilia and Ineducabilia "subclasses", and the sequence of the subfamilies 15 and 16, 38 and 39, 54 and 55, are severally reversed. Compared with the first arrangement, the Hippopotamina, Rhinocerotina, and Tapirina are transfers from the Elephantidae to the Suidae; a new subfamily (23) Dinotheriina forming with (34) Elephantina, the Elephantidae, is interposed, whereby a total of 41 families and 76 subfamilies results. These modifications indicate the author's emendations since 1839, and therefore not the status of the article at the date of "reading".]
- Coates, B. H.** [On the use of the sutures of the cranium.] <Proc. Acad. Nat. Sci. Phila. i, 1841, pp. 69-71.
- Fennell, J. H.** A natural history of British and foreign quadrupeds; containing many modern discoveries, original observations, and numerous anecdotes. 8°. xv, 556 pp., 200 woodcuts. London, Joseph Thomas, 1841.
- Jones, T. R.** A general outline of the animal kingdom, and manual of comparative anatomy. 8°. xiv, 732 pp., 336 figs. London, J. Van Voorst, 1841.
- Martin, W. C. L.** A general introduction to the natural history of mammiferous animals, with a particular view of the physical history of man, and the more closely allied genera of the order Quadrumana, or monkeys. Illustrated with 296 anatomical, osteological, and other incidental engravings on wood, and 12 full-plate representations of animals, drawn by William Harvey. 8°. 1 p. l., 545 pp., 12 pl. London, Wright & Co., 1841.
- Pompper, H.** Die Flügethiere, Vögel und Amphibien, nach ihrer geographischen Verbreitung tabellarisch zusammengestellt. 4°. Leipzig, 1841.
- 1842.—**Duvernoy, G. L.** Supplément historique pour les mémoires, "Sur les dents des mammifères." <Comptes Rendus, Paris, xv, 1842, pp. 1000-1006.
- Gray, J. E.** Descriptions of some new genera and fifty unrecorded species of mammalia. <Ann. Mag. N. H. x, 1842, pp. 255-267.
- Lesson, R. P.** Nouveau tableau du règne animal. Mammifères. 8°. 3 p. l., 204 pp. Paris, A. Bertrand, 1842.
- Meyer, G. H.** Ueber das Säugethierei. <Archiv für Anat. 1842, pp. 17-18.
- Schinz, H. R.** Ueber seine Synopsis Mammalium. <Verhandlgn. d. Schweiz. naturf. Gesellsch. 27. Versammg. Altdorf, 1842, pp. 116-126.
- Smith, C. H.** The naturalist's library. Edited by Sir William Jardine, Bart. Vol. xv. Mammalia. Introduction to mammalia. 18°. Eng. title, 4 p. l., pp. 17-313, portrait of Drury, 30 col. pl. Edinburgh, W. H. Lizars [1842].
- 1843.—**Bischoff, T. L. W.** Ueber die erste Bildung des Centralnervensystems bei Säugethiere, mit Berücksichtigung der kritischen Beleuchtung meiner Beobachtungen durch Herrn Dr. Reichert. Mit 1 Taf. <Müller's Arch. f. Anat. 1843, pp. 252-275.
- Gray, J. E.** Descriptions of some new genera and species of mammalia in the British Museum collection. <Ann. Mag. N. H. xi, 1843, pp. 117-119.
- Gray, J. E.** List of the specimens of mammalia in the collection of the British Museum. Printed by order of the trustees. 16°. xxviii, 216 pp. London, 1843.
- Hays, I.** [On papers relating to Koch's collection.] <Proc. Am. Philos. Soc. Phila. ii, 1843, pp. 264-266.
- Owen, R.** Letter on R. Harlan's notice of new fossil mammalia. <Am. Journ. Sci. and Arts, xlv, 1843, pp. 341-345.
- Waterhouse, G. R.** Observations on the classification of the mammalia. <Ann. Mag. Nat. Hist. xii, 1843, pp. 389-412; Rep. Brit. Assoc. 1843 (pt. 2), pp. 65-67; Nuovi Ann. Sci. Nat. iii, 1845, pp. 371-386.
- 1844.—**Bischoff, T. L. W.** Recherches sur la maturation et la chute périodique de l'œuf de l'homme et des mammifères. Avec 6 planches. <Ann. Sci. Nat. 3e sér. Zool. tome ii, 1844, pp. 104-164.
- Bonaparte, C. L.** Specchio generale del sistema masto-zoologico. <Riunione degli Scienziati Italiani, atti della prima riunione, Lucca, 1844, pp. 323-356.
- Bourguery, J. M.** Sur les masses comparatives que présentent dans l'homme et quelques animaux mammifères les différents organes qui composent le système nerveux. <Compt. Rend. Acad. Sci. Paris, tome xix, 1844, pp. 603-607; Institut, xii, no. 561, 1844, p. 391.



- 1844.—**Milne-Edwards, H.** Considérations sur quelques principes relatifs à la classification naturelle des animaux, et plus particulièrement sur la distribution méthodique des mammifères. < Ann. Sci. Nat. 3e série, Zoologie, tome I, 1844, pp. 65-99, with folded tab.
- Pouchet, F. A.** Recherches sur la progression et l'état du fluide seminal dans les organes génitaux des femelles des mammifères. < Comp. Rend. Acad. Sci. Paris, xix, 1844, pp. 1362-1363; Institut, xii, no. 573, 1844, p. 422.
- 1844-45.—**Schins, H. R.** Systematisches Verzeichniss aller bis jetzt bekannten Säugethiere, oder Synopsis Mammalium, nach dem Cuvier'schen System. 2 vols. 8°. Vol. i, 1844, pp. iv, 574. Nachtrag zum ersten Bande, 51 pp. Vol. ii, 1845, Solothurn. Jent und Gasemann, 1844-45.
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- 1672.—Jocelyn, J. New England's rarities, discovered in birds, beasts, fishes, serpents, and plants of that country. 18°. London, 1672.
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- 1703.—La Hontan, C. Baron de. Voyages dans l'Amérique de M. C. Baron de la Hontan. 2 vols. 12°. La Haye, 1703.
- 1709.—Lawson, J. A new voyage to Carolina. 4°. London, 1709.
- 1711.—Lawson, J. Description of North Carolina. London, 1711.
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- 1774.—Du Pratz, Le P. The history of Louisiana, or the western parts of Virginia and Carolina, containing a description of the countries that lie on both sides of the river Mississippi, with an account of the settlements, inhabitants, soil, climate and products. Translated from the French of M. le Pape du Pratz [8°. 3 vols. Paris, 1758]. A new edition. 8°. London, 1774.  
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- 1780.—**Fabricius, O.** Fauna Grœnlandica, systematicæ sistens animalia Grœnlandiæ occidentalis hæc-  
tenus indagata, quoad nomen specificum, triviale, vernaculumque; synonyma avetorum  
plurimum, descriptionem, locum, victum, generationem, mores, usum, capturamque singulorum,  
provi detegendi occasio fuit, maximaque parte secundum proprias observationes Othonis Fab-  
ricii ministri evangelici, quondam Grœnlandiæ ad coloniam Friderichshavn, . . . Hafniæ et  
Lipsiæ, impensis Joannis Gottlob Rothe. . . . mdcclxxx. 8°.
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[This is said to have furnished Mr. Pennant with much information respecting the mammalogy of the region.]
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enlarged in the winter of 1782, for the use of a foreigner of distinction, in answer to certain  
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ains, &c. [Paris,] mdcclxxxii. pp. 391. 8°.  
[This 1st ed. of Jefferson's "Notes" was printed in Paris for private circulation (300 copies) without title-  
page, and is not to be regarded as published. I have not seen a copy; above title is quoted from Bartlett's Cata-  
logue of the Library of John Carter Brown. From this came a French version, 1786; some say also 1785. For  
circumstances of the work prior to the regular publication of the English ed., see Bartlett, op. cit., 102; and  
especially Randall's Life of Jefferson, vol. i, p. 414 (5°, New York, 1859).—The date, 1782, is supposed to be that  
of preparation, not of printing, of the work. There have been numerous imprints; O'Callaghan's list of them  
(with some additional data) is as follows:—Ed. of 1782, without a title-page, 300 copies [privately printed].—Phil-  
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Jefferson's list of mammals acquires date].—8°, Philadelphia, Prichard & Hall, 1788, Philadelphia, 1792.—Philadel-  
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- 1784.—**Cook, J.** Voyage to the Pacific Ocean in 1776-1780, performed under the direction of Captain  
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cc pp., 3 l., 185 pp., frontisp., 8 pl. London, printed by Henry Hughes, mdcclxxxiv.  
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viii, 290, 1 l. map, tab. [Contient une liste des mammifères de la Virginie.]  
[A copy of the privately printed edition of 1782 having been surreptitiously obtained, this French version was  
made, printed, and published in advance of the authentic English ed. of 1787. See what is said under heads of  
the eds. of 1782 and 1787. The French version is utterly condemned by Jefferson. (See Randall's Life, vol. i, p. 314.)]
- 1787.—**Jefferson, T.** Notes [on the] State of Virginia. [Written by Thomas Jefferson. | Illustrated  
with | a map, including the States of Virginia, | Mary- | land, Delaware and Pennsylvania.  
| — | 8°. London: | printed for John Stockdale, opposite | Burlington House, Piccadilly. |  
mdccclxxxvii. 1 vol. 8°. 2 p. l., 385 pp., map and folded table. [Contains a nominal list of  
animals of the State.]  
[The original draft of this work, which bears date 1782, was imprinted (300 copies) for private circulation,  
without title-page, and cannot be considered as published. There was an anonymous French version in 1786.  
The English ed. of 1787 being the first one published with sanction of the author, and avowed by him, is the one  
from which Jefferson's list of the mammals acquires its proper date. (See the eds. of 1782 and 1786.)]
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- 1790.—**Meares, J.** Voyages to the northwest coast of America in 1788 and 1789. 4°. London, 1790.
- 1794.—**Williams, S.** Natural and civil history of Vermont. 8°. Walpole, N. H., 1794. 2d ed. 2 vols.  
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- 1804.—**Durand, M.** Abstract of a communication relative to fossil bones, &c., of the county of Ope-  
lousa west of the Mississippi to Mr. William Dunbar of the Natchez, and by him transmitted  
to the society. < Trans. Am. Philos. Soc. Phila. vi, 1804, no. 2, pp. 55-68.
- Watkins, J.** Notices of the natural history of the northern parts of Louisiana, in a letter from  
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- 1807.—**Gara, P.** A journal [of the] voyages and travels [of a corps of discovery,] under the command of Capt. Lewis and Capt. [Clarke of the army of the United States,] from [the mouth of the river Missouri through the] interior parts of North America [to the Pacific Ocean,] during the years 1804, 1805, & 1806. [Containing] an authentic relation of the most interesting transactions [during the expedition,—a description of the country,—] and an account of its inhabitants, soil, climate, curiosities [and vegetable and animal productions.] — [By Patrick Gass,] one of the persons employed on the expedition. [—] [With geographical and explanatory notes] by the publisher. [—] [Copyright secured according to law.] [Pittsburgh,] printed by Zadok Cramer, [for David M'Kechnan, publisher and proprietor, . . . 1807.] 1 vol. 12°. i-viii, 9-262 pp. (No illustrations.)

[There are several later editions. The book refers to various mammals *passim*. See Lewis and Clarke, 1814.]

- Hearne, S.** Journey to the northern ocean, by Samuel Hearne, in the years 1769, 1770, 1771, and 1772. London, 1807.

- 1808.—**Cuvier, G.** Des os fossiles trouvés dans l'Amérique septentrionale. < Journ. de Phys. lxvii, 1808, pp. 331-333.

- 1811.—**Rees, T.** Travels on the Missouri and Arkansas, by Lieutenant Pike, in 1805 and 1806. Edited by T. Rees, esq. London, 1811.

- 1814.—**Brackenridge, H. M.** Views of Louisiana. . . . 8°. Pittsburg, 1814.

**Lewis, M., and Clarke, W.** History [of the] expedition [under the command of] Captains Lewis and Clark, [to] the sources of the Missouri, [thence] across the Rocky Mountains [and down the] river Columbia to the Pacific Ocean. [Performed during the years 1804-5-6.] By order of the [government of the United States.] [Prepared for the press] by Paul Allen, esquire. [In two volumes.] Vol. I-[II]. Philadelphia, [published by Bradford and Inskeep; and] Abm. H. Inskeep, New York. [J. Maxwell, printer.] 1814. 2 vols. 8°. Vol. I, i-xxviii, 1-470 pp., maps. Vol. II, i-ix, 1-522 pp., maps. (> Vol. II, Chap. V:1, "A general description of the beasts, birds, and plants, &c. found by the party in this expedition", pp. 148-201.)

[This is the original ed. of the authentic narrative; there are many others later, q. v. See especially Coates, Bull. U. S. Geol. Surv. no. 6, 2d ser. 1878, pp. 417-444, for an account of these books, and of numerous spurious or collateral publications relating to the travels of these explorers.]

Contains *passim*, and particularly at the place above specially indicated, an account of numerous mammals observed in the region traversed; none under binomial names; some of the accounts are our original notices of species. The mammalogical matter is important, as the basis of various binomial species, especially of *Ord* and *Rafinesque*.]

**Lewis, M., and Clarke, W.** Travels [to the] source of the Missouri River [and across the American continent] to the [Pacific Ocean.] [Performed] by order of the government of the United States, [in the years 1804, 1805, and 1806.] — [By Captains Lewis and Clarke.] — [Published from the official report,] and [illustrated by a map of the route,] and other maps. [—] [London:] printed for Longman, Hurst, Rees, Orme, and Brown, [Paternoster-Row,] — [1814. One vol. 4°. i-xxiv, 1-663 pp., 1 folding and 2 full-page maps. (> Chap. XXIV, "A general description of the beasts, birds, and plants, &c., found by the party in this expedition", pp. 450-489.)]

[Nearly identical, except in form, with the orig. ed. of same date, q. v.]

- 1815.—**Lewis, M., and Clarke, W.** Travels [to the source of] the Missouri River [and across the] American continent [to the] Pacific Ocean. [Performed] by order of [the government of the United States,] in the years 1804, 1805, and 1806. [—] [By Captains Lewis and Clarke.] — [Published from the official report,] and [illustrated by a map of the route,] and other maps. [—] [A new edition, in three volumes.] Vol. I, [II, III]. [—] [London:] printed for Longman, Hurst, Rees, Orme, and Brown, [Paternoster-Row,] 1815. 3 vols. 8°. Vol. I, pp. i-xxvi, 1 l. not paged, 1-411, maps 3. Vol. II, pp. i-xii, 1-14, maps 3. Vol. III, pp. i-xii, 1-394. (> Vol. III, Chap. XXIV, "A general description of the beasts, birds, plants, &c., found by the party in this expedition", pp. 1-73.)

[Except in form, and in some minor details of typography incident to resetting of the type, this is identical with the 4th edition of 1814, q. v. It was reissued, 1817.]

**Lewis, M., and Clarke, W.** "Tagebuch o. Entdeckungsexpedition durch Nord-Amerika in d. Jahren 1804-6. Aus d. Engl. v. Weyland. Mit 1 Karte." < Neue Bibliothek der wichtigsten Beschreibungen u. s. w. (Weimar, gr.-8°, Bd. 1, 1815).

[Title of a German version, quoted from Kayser. See the original, 1814.]

- 1815-20.—**Ord, G.** "A universal geography, or a view of the present state of the known world. Originally compiled by William Guthrie, esq.; the astronomical part by James Ferguson. Second American edition, 2 vols. 8vo. Philadelphia, 1815. Third American edition, 2 vols. 8vo. and one of maps, Philadelphia, Benjamin Warner, 1820."
- [The foregoing copied from Baird. The work is rare. The only copy I have seen is entitled: "A new | geographical, | historical, | and commercial grammar; | and present state of the | several kingdoms of the world." Containing | [ . . . ] Johnson and Warner. Vol. ii, Philadelphia, 1815." This may not be exactly the same book as cited by Baird; it consists of prel. pp. pp. 1-603, maps, and has Ord's zoological matter at pp. 390-361, as cited by Baird. Mr. Ord's work here consists of compiled nominal lists of vertebrates, in which scientific names are originally imposed upon nearly all the species described by Lewis and Clarke, followed by descriptions of many of them. In the 3d ed. above cited from Baird, the lists of systematic names are omitted, but the other zoological matter is retained at pp. 141-189 of vol. i; Mr. Ord's name, however, is not given.]
- 1816-18.—**Lewis, M., and Clarke, W.** Reize | naar | de Bronnen van den Missouri, | en door het vaste land van America | naar de Zuidzee. | Gedaan op last van de regering der Vereenigde Staten van America, | in de jaren 1804, 1805 en 1806. | Door de Kapiteins | Lewis en Clarke. | Met eene kaart | — | Uit het Engelsch vertaald door | N. G. Van Kampen. | — | Eerste, [tweede, derde en laatste,] deel. | \* | Te Dordrecht, | bij A. Blinse & Zoon, | 1816 [1817, 1818]. 3 vols. 8°. V. I. I, 1816, pp. i-xxxii, 1-398, map. Vol. II, 1817, pp. i-viii, 1-390. Vol. III, 1818, pp. i-xii, 1-335.
- [This appears to be a fair and complete version, probably made from the English 3-vol. edition of 1815, g. v.]
- 1817 (prior to).—**Le Raye, C.** Journal of Charles Le Raye, etc.
- [I cite from memory a rare book I have seen; contains a curious figure of *Antilocapra*.]
- 1817.—**Bradbury, J.** Travels in the interior of North America in the years 1809, 1810, and 1811. 8° Liverpool, 1817.
- Lewis, M., and Clarke, W.** Travels, etc.
- [An Irish edition of the work; 2 vols. 8°, Dublin, J. Christie, 1817. Said to be like the original.]
- Rafinesque, C. S.** Descriptions of seven new genera of North American quadrupeds. < Amer. Monthly Mag. ii, 1817, pp. 44-46.
- [*Mazama*, *Diplostoma*, p. 44; *Geomys*, *Cynomys*, *Anisonyx*, *Mynomes*, p. 45; *Lynx*, p. 46.]
- 1818.—**Rafinesque, C. S.** Further discoveries in natural history, made during a journey through the Western States. < Amer. Monthly Mag. iii, 1818, pp. 445, 446.
- [*Musculus leucopus*, *M. nigricans*, etc.]
- 1819.—**Leach, W. E.** Notice of some animals from the arctic regions. < Thomson, Ann. Phil. xiii, 1819, pp. 60-61.
- Rafinesque, C. S.** Prodrome de soixante-dix nouveaux genres d'animaux découverts dans l'intérieur des États-Unis d'Amérique, durant l'année 1818. < Journ. de Phys. lxxviii, 1819, pp. 417-429.
- Warden, D. B.** A statistical, political, and historical account of the United States of North America. . . . By D. B. Warden. 3 vols. 8°. Edinburgh, 1819.
- [Numerous compiled notices of North American mammals.]
- 1820.—**Harmon, D. W.** A journal of voyages and travels in the interior of North America, between the 47th and 58th degrees of latitude, by Daniel William Harmon, a partner in the North West Company. Andover, 1820.
- Rafinesque, C. S.** Annals of nature, or annual synopsis of new genera and species of animals, plants &c. discovered in North America. 8°. Pamphl. 1820.
- Warden, D. B.** Description statistique, historique et politique des États-Unis de l'Amérique septentrionale, depuis l'époque des premiers établissemens jusqu'à nos jours; par D. B. Warden. . . . Edition traduite sur celle d'Angleterre, . . . 5 vols. 8°. Paris, 1820.
- [Tome v, chap. xix, "Des quadrupèdes ou mammifères des États-Unis", pp. 606-643. Many changes introduced from the English edition.]
- 1821.—**Schoolcraft, H. R.** Travels to the sources of the Missouri River. Albany, 1821.
- 1823.—**Sabine, J.** Narrative of a journey (first) to the shores of the polar seas in 1819-1822. By Captain Franklin. . . . 4°. London, 1823.
- [Appendix, mammals, by J. Sabine.]
- Say, T.** Account of an expedition from Pittsburgh to the Rocky Mountains, performed in the years 1819 and '20, under the command of Major Stephen H. Long. Compiled by Edwin James. 2 vols. 8°. Philadelphia, 1823.
- [Contains numerous important notices and original descriptions of mammals, by Thomas Say.]



- 1823.—**Scoresby, W.** Journal of a voyage to the northern whale-fishery. . . . 1 vol. 8°. Edinburgh, 1823.  
[Zoological appendix on the mammals of Greenland. *Mus grænicus*, Traill, n. sp., p. 417.]
- 1824.—**Sabine, E.** Journal of a voyage for the discovery of a northwest passage from the Atlantic to the Pacific, performed in the years 1819 and 1820, in His Majesty's ships Hecla and Griper. By Capt. W. E. Parry: with a scientific appendix. . . . 2 vols. 4°. London, 1821.—Supplement to the appendix. . . . Vertebrata. By Edward Sabine. 4°. London, 1824.
- 1825.—**Harlan, R.** Fauna Americana: being a description of the mammiferous animals inhabiting North America. 8°. 318 pp., 1 l. Philadelphia, published by Anthony Finley, J. Harding, printer, 1825.
- Richardson, J.** Journal of a second voyage for the discovery of a northwest passage from the Atlantic to the Pacific, performed in 1821-23 in His Majesty's ships Fury and Hecla. By Capt. W. E. Parry. 4°. London, 1824.—Appendix: Vertebrata, by Dr. J. Richardson. 4°. London, 1825.
- 1826-28.—**Godman, J. D.** American natural history. Vol. i [vol. ii]. Part i. Mastology. Philadelphia, H. C. Carey and I. Lea, Chestnut-street, R. Wright, printer, 1826. [8°. Vol. i, eng. title, xvi + 17-362 pp., 21 pl.; vol. ii, eng. title, 331 pp., 19 pl.] Vol. iii. Part I. Mastology. Philadelphia, Carey, Lea & Carey, Chestnut-street, 1828. [Eng. title, 264 pp., 9 pl.]  
[The foregoing is the original edition, now a rather rare work. A second edition, in three vols. 8°, was published in 1831, at Philadelphia, by Stoddart & Atherton. It is supposed to have been printed from the original stereotypes, as there appears to be no alteration. There is at least one other edition, of much later date.]
- 1827.—**Harlan, R.** Notice of certain prepared specimens of quadrupeds in the possession of a gentleman lately returned to Philadelphia from his travels in the United States and Territories. < Journ. Acad. Nat. Sci. Phila. vi, 1827, pp. 55-56.
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[Two vols. 18<sup>68</sup>, some of the issues forming part of Harper's series, "The Family Library". Vol. I, pp. i-vi, 1<sup>st</sup>-v<sup>th</sup>, vii-ii, 53-371, 3 maps. Vol. II, pp. i-x, 11-303, 3 maps. (> Vol. II, Appendix, "Further enumeration and description of the quadrupeds, birds, fishes, and plants noticed during the expedition", pp. 330-378.)

Memoranda of the dates of the successive issues, most of which consisted of 350 copies:—September, 1849; January, 1849; May, 1849; January, 1849; July, 1849; April, 1847; May, 1850; August, 1851; June, 1853; April, 1856; November, 1850; February, 1856; March, 1871 (vol. II); April, 1878 (vol. II); February, 1874 (vol. II); December, 1875 (vol. II), in all fourteen issues of the whole work, under sixteen different dates.

This is an editorial abridgment, or digest, of the original of 1814, &c., faithfully and, on the whole, judiciously executed. The natural-history chapter, besides being relegated to an appendix, is transposed as to its botanical and zoological portions. It is furthermore abridged at the editor's discretion, the omissions being indicated by asterisks. A new feature is foot-note references to the pages of the body of the work on which the various species were before mentioned. This is a valuable set of cross-references, for the narrative accounts scattered through the work are often no less important than the formal notices themselves.]

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[The plates of this work are said to have been originally published in numbers, in oblong folio, without text, beginning as far back as 1849. The plates in the edition above given are in roy. 8<sup>o</sup>, intercalated with the text.

Another edition or reprint, in roy. 8<sup>o</sup>, plates intercalated, appears, pub. by V. G. Audubon, in numbers, 1851-54, designed to be bound in 3 vols. The copy examined is as follows:—"The quadrupeds of North America. . . . Vol. I. New York, published by V. G. Audubon, 1851", pp. i-viii, 1-384, pl. 1-50; Vol. II (no title-page), pp. 1-334, 1 l., pl. 51-100. Vol. III, 1854, 1 p. l., pp. i-v, 1-348, pl. 101-155. Vols. II and III thus seem to be identical with the originals. Though vol. III is dated 1854, pp. 1-354 are said to have appeared in 1853, the remainder in 1854.

These authors treat of 197 species, of which about 160 are figured. Few are here described as new, the original descriptions having mostly appeared elsewhere. See e.g. under dates 1839 and 1841. The technical portions of the work are supposed to be mainly attributable to Bachman, the other author having attended to the illustrations and portions of the biographical matter. Many of the plates were drawn by J. W. Audubon.]

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[The preceding title is that of a separate edition issued from the same stereotype plates as the government edition. The latter bears the title of "Exploration and survey of the valley of the Great Salt Lake of Utah, including a reconnaissance of a new route through the Rocky Mountains. By Howard Stansbury, capt. corps topographical engineers. Printed by order of the Senate of the United States. Philadelphia, Lippincott, Grambo & Co., 1852." (An edition of the same work was subsequently printed by the Public Printer for the House of Representatives in 1853. This is much inferior in typography and illustrations.) The zoological portion of Stansbury's report was published in a separate pamphlet by the Smithsonian Institution, from the same stereotype plates, under the title of "Zoology of the valley of the Great Salt Lake of Utah. Mammals, by S. F. Baird, &c. Extracted from Capt. H. Stansbury's report to the United States Senate, March 10, 1852." 8°. Philadelphia, Lippincott, Grambo & Co., June, 1852. The entire work was published early in 1852. The pamphlet edition of the zoology was published and distributed in June, 1852.—(Baird.)]

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1. Abhandlung: Selbstständige Mittheilungen über den Bau des Zobel (*Mustela zibellina* var. *asiatica* und *americana*) im Vergleich mit dem des Baer- und Steinmarders. (Mit 4 Taf.) p. 3.
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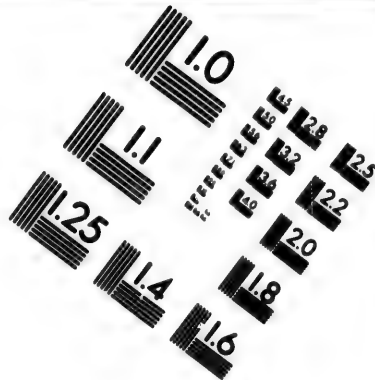
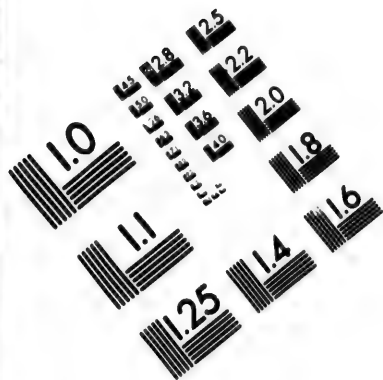
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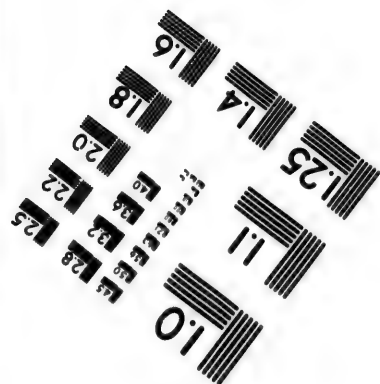
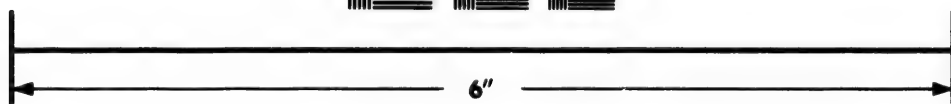
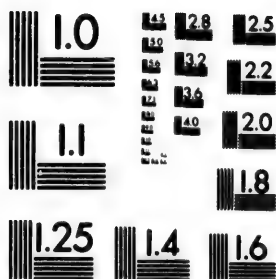
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 [These two publications were simultaneous, and only differ in the titles. The following are the contents:—  
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Map and 19 plates, each with unpaired explanatory leaf.

A complete and thoroughly reliable history of the most conspicuous and most important quadruped of America, prepared with the greatest care and pains, after protracted and patient research, by one of the most eminent zoologists of the country.]

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[A republication of the original memoir (see 1876) under Dr. Coues's editorship, with the following changes:—  
1. The omission of the illustrations, explanatory pages, and textual references.  
2. The omission of the portion relating to the extinct species, the present reprint being confined to the one existing species, beginning at page 36 of the original.  
3. The incorporation of the appendices in the body of the text.  
4. The addition of much new matter by the author himself.  
5. Various minor modifications with the slight alteration, chiefly verbal, of context incident thereto.  
6. Alteration of the title and substitution of editorial place for the preliminary matter of the original.  
No editorial abridgment or digest of any part of the memoir was made, the portions of the memoir here reproduced being according to copy furnished by author, who added much new matter and made some little changes *passim* in the context. A few editor's notes, chiefly explanatory of modifications of the text, are introduced in brackets.]
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[In most respects the best treatise extant on the subject. Of the Cervidae, all of which the author refers to the genus *Cervus*, 3 N. Amer. spp. are recognized:—*C. alces*, *canadensis*, *tarandus*, *tarandus arcticus*, *macrotis columbianus*, *virginianus*, and *acapulcensis*.]
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[v. 1.] Petri Artedi Angermannia-Sueci Bibliotheca ichthyologica an historia litteraria ichthyologiae in qua recensio sit auctorum, qui de piscibus scripsere, librorum titulus, loco & editionis tempore, additis iudiciis, quid quis auctor praestiterit, quali methodo et successu scripserit, disposita secundum saecula in quibus quisque auctor floruit. Ichthyologiae pars i.—Lugduni Batavorum, apud Conradum Wishoff. 1738. [iv, 66, 2 pp.]  
[v. 2.] Petri Artedi Sueci Philosophia ichthyologica in qua quicquid fundamenta artis absolvit: Characterum scilicet genericorum, differentiarum specificarum, varietatum et nominum theoria rationibus demonstratur, et exemplis comprobatur. Ichthyologiae pars ii.—Lugduni Batavorum, apud Conradum Wishoff. 1738. [iv, 92 pp.]  
[v. 3.] Petri Artedi Sueci Genera piscium. In quibus systema totum ichthyologiae proponitur cum classibus, ordinibus, generum characteribus, specierum differentis, observationibus plurimis. Redactis speciebus 342 ad genera 52. Ichthyologiae pars iii.—Lugduni Batavorum, apud Conradum Wishoff. 1738. iv, 88 pp.

[v. 4.] Petri Artedi Angermannia-Sueci *Synonymia piscium fere omnium*; in qua recensio fit nominum piscium, omnium facile authorum, qui unquam de piscibus scripsere: uti Græcorum, Romanorum, Barbarorum, nec non omnium insequentium ichthyologorum una cum nominibus inquilinis variarum nationum. Opus sine pari. Ichthyologia pars iv.—Lugduni Batavorum, apud Conradum Wischoff. 1738. iv, 118, 22 pp.

[v. 5.] Petri Artedi Sueci *Descriptiones specierum piscium quos vivos præsertim dissecuit et examinavit*, inter quos primario pisces regni Sueciæ facile omnes accuratissime describuntur cum non paucis aliis exoticis. Ichthyologia pars v.—Lugduni Batavorum, apud Conradum Wischoff. 1738. iv, 102 pp.

[As indicated in the title of the "Genera piscium" (v. 3), Artedi admitted into the system 242 nominal species under 54 genera, but in this number are included the Cetaceans (14 species representing 7 genera), which were regarded as constituting an order of fishes named Plagiuri.]

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1741.—Klein, J. T. Jacobi Theodori Klein *Historiæ piscium naturalis promovendæ missus secundus de piscibus per pulmonibus spirantibus [Cete] ad iustum numerum et ordinem redigendis.*—Accesserunt singularia: de i. Dentibus balænarum et elephasitina. ii. Lapide manati et tiburouia.—[Motto.] Cum figuris.—Gedani, literis Schreiberianis. 1741. 4°. 3 p. l., 38 pp., 1 l., 6 tab.

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[Forms part of the Tableau Encyclopédique et Méthodique des trois Règnes de la Nature, tome cxxxiii.]

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1792.—Walbaum, J. J. Petri Artedi Sueci genera piscium. In quibus systema totum ichthyologiæ propouitur cum classibus, ordinibus, generum characteribus, specierum differentiis, observationibus plurimis. Redactis speciebus 242 [228] ad genera 62 [45]. Ichthyologia pars iii.—Emendata et aucta a Iohanne Inlio Walbaum M. D., Societatis Berolinensis Naturæ Curiosorum, et Societatis Litterariæ Lubecensis Sodali. Cum tabula aenea.—Grypeswaldia, impensis Ant. Ferdin. Ant. Ruse 1792. 8°. 4 p. l., 723 pp., 3 pl.

[A poor compilation, like Gmelin's, in which the various previously described species were introduced without a critical study into the system, and described in foot-notes in connection with the Artedian species, but combined under the Linnæan genera. The nominal species (and many are only nominal), excluding the cetaceans, are thus raised from 328 to about 985, without counting the species enumerated under the new genera of authors appended to the volume. The compilation has some value, not only on account of the original descriptions of species copied from previous authors, but because of the reproduction of the descriptions of the new genera introduced by various authors into the system. It is also of interest to the student of American species by reason of the incorporation therein, under specific names, of anonymous American species described by Schoepf.]

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## N.—RODENTIA.

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## Q.—ADDENDA.

[For most of the following titles, the compilers are indebted to the kind attentions of Mr. J. A. Allen. They were received during the printing of the Bibliography, but too late for insertion under their proper heads, and represent, in particular, many important paleontological papers by Leidy, Marsh, and Cope.]

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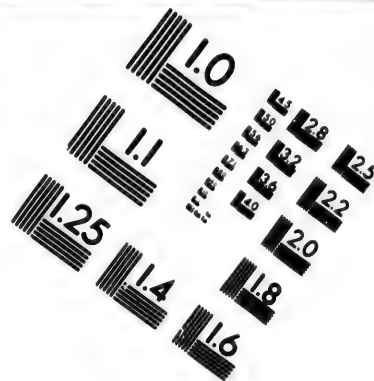
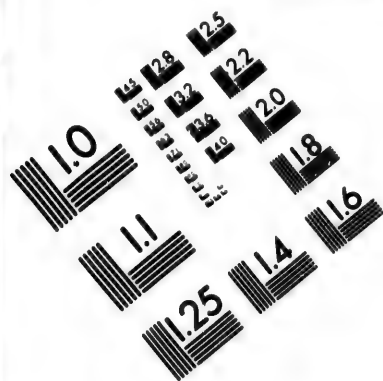
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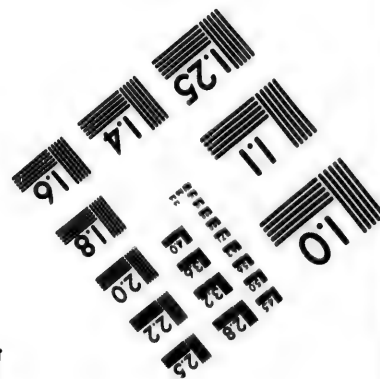
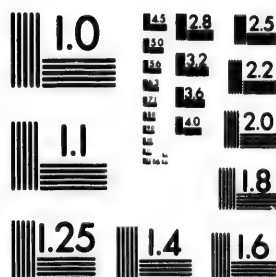
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